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THE GRASSLANDS OF NEW ZEALAND.

SERIES II. THE MID-WEST NORTH ISLAND HILL COUNTRY.

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4. DETAILED REVIEW OF GRASSES AND CLOVERS FOR HILL COUNTRY.

IN the June, 1925, issue of this *Journal* (pages 357–74) an effort was made to classify the pasture species and to outline those factors which in the main are responsible for change in the composition of pastures. It is intended in this and subsequent articles to deal with the individual grasses and clovers, particularly in regard to the position each occupies, or should occupy, on hill country such as that predominating in the mid-west districts of the North Island.

Before considering in detail the relative position of each grass and clover for the hill country in question it may be worth while to discuss a few fundamental truths in regard to hill country in general. Viewed broadly, most hill country differs widely from the fertile plain (Fig. 43). No farm implement aids the settler in his efforts to secure a good seed-bed or to ameliorate the soil by exposing it to the recuperative influence of air and sun. The primary forest burn provides a good seed-bed and a plentiful supply of plant-food for the first few years, but with the large tracts reverted to secondary growth the seed-bed is hard and the supply of plant-food often scanty. In both primary and secondary burns there is a great diversity of seed-beds (Figs. 44–47)—easy sloping foothills, steep slopes, gullies, ridges, subsoil outcrops (sandstone, papa, limestone, greywacke, and the like), rubbly places, shingle-slips, land-slips, wet seepage-places, small swampy areas, dry, hard knolls, pukahu and other unconsolidated surfaces, volcanic deposits (pumice, &c.)—and on all sides the competition of the secondary growth manifesting itself after the fire or following on certain specific methods of farming the country. Shady and sunny slopes also greatly complicate the problem of grassing and of managing the country.

It is this variation in seed-bed, in soil, and in aspect that makes one ponder in considering the grasses and clovers that should be sown.

There is still a wide persistence in the belief that it is possible to establish and maintain good rye-grass, cocksfoot, white clover, &c., on hill country, and the invasion among these species of so-called inferior grasses is looked upon as a great misfortune.

All change in composition of pastures can be directly traced to a set of causes reflecting upon the individuality of the species. Each species has more or less its set station, defined by the plant-food available, the amount of light and shade persisting, the measure of heat or cold, of wetness or dryness, the consistency of soil-particles —whether heavy soils, light soils, consolidated or unconsolidated soils —and chemical composition—whether limestone, saline soils, &c. Upon these depend the growth of the individual and subsequent change in composition of pastures. Change seems to be governed almost entirely

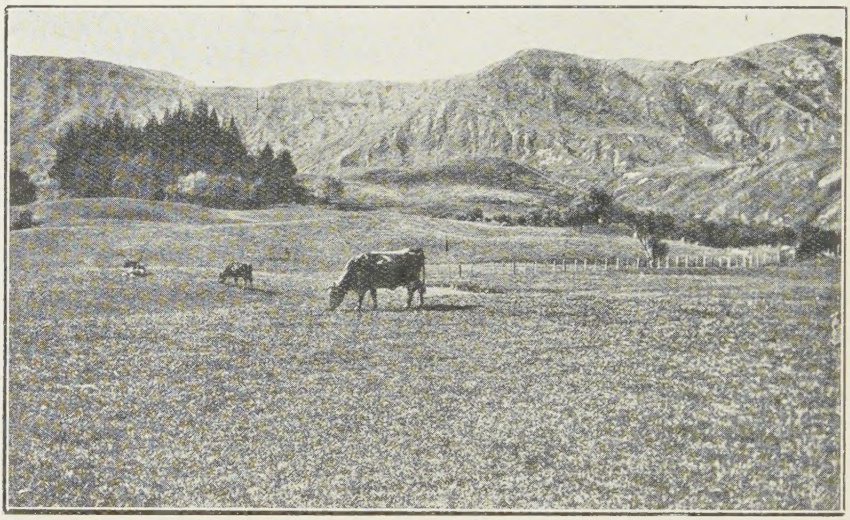

FIG. 43. THE EASIER PLOUGHABLE COUNTRY WHICH CAN BE IMPROVED AT WILL BY THE FARMER, AND THE HARDER PROPOSITION BEYOND.

[Photo by E. B. Levy.

by bulk or quantity of herbage produced by the individual species within the pasture association. Certain grasses and clovers are capable of producing more bulk than others; thus rye-grass, properly natured, produces immensely more bulk of herbage than does danthonia similarly well natured. The species that produces the greatest bulk, therefore, is destined to become the dominant one within any pasture association. Management, of course, plays an enormous part, and the governing of bulk in pastures by careful management is one of the fundamentals of good pasture establishment, utilization, and maintenance.

When carefully studied the direction of change in pasture-composition indicates very clearly the conditions existing within that pasture sward, and it is only by interpreting these changes aright that we can get down to bed-rock so far as sound pasture-management is concerned. In the past we have often misinterpreted Nature in her effort to keep

the soil-surface covered by some form of vegetation. We must remember that plant-forms have been evolved through ages of time, and that during that period a plant, or plants, have been evolved to fit almost every conceivable situation. It is for the farmer to so manage conditions and environment that the plants he wishes to see on his farm may have the correct conditions for their proper growth. Where it is not economically sound to alter conditions, then every effort should be made to get species established that are suited to his particular conditions, rather than waste money on the sowing of other species that are quite unsuited to the country he is endeavouring to grass. With most hill country in New Zealand we have got to get away from the idea that the country is good enough for rye-grass. We must sow for all aspects, not just for those pockets of better soil and easier aspect.

How often has the farmer been inclined to vent his wrath on poorer, inferior grasses or weeds coming in and replacing his better grasses that cost him so much hard cash, time, and labour to sow! Were the signs of the development properly interpreted and heeded, these would signify something wrong with the soil conditions or management of the pasture, which when corrected would give rise to something nearer the type of pasture the farmer desired to see. Just what the appearance or disappearance of each plant means or signifies in grassland does not come within the scope of this article, although this phase of pasture-study is one of intense interest and value. It suffices for the present to say that, given the right set of conditions, there is practically no inferior grass or weed that can compete successfully with vigorous strong-growing rye-grass, cocksfoot, and clover. When these are sown, therefore, and inferior grasses and weeds make their appearance in the pasture, this is a certain indication that conditions have become unfavourable for the proper growth of the rye-grass, cocksfoot, and clovers.

Turning again to the early primary forest burn, with its remarkable growth of grass for the first few years and its turnip crop within the first six months, what a splendid indication there is of wealth left in the wake of a good burn. In the development of the North Island forest country was it any wonder that men were deceived by the early promise? Then, again, we have in New Zealand certain wonderful areas of forest hill country, typified by much of the Rangitikei County, which is still holding a very fair proportion of the best English grasses originally sown. Pioneers from this fertile block went farther afield and tackled country similarly forested, putting into operation the same practices as those so successfully applied in the Rangitikei. But surface-soil conditions and the favourable climate for secondary growth —ferns, scrub, &c.—made the experience of the Rangitikei of little value. Further experience had to be gained, different methods had to be employed, larger expenditure was necessary. Where the farmer was unable to adapt himself to the new conditions or to bear the additional expenditure for the necessary fencing, crushing, &c., to-day we see these areas more or less covered with rank secondary growth. The task of winning back that reverted country is one of the leading pastoral problems New Zealand has to face at the present time. The species of grasses and clovers originally sown on the country now reverted to secondary growth contributed in no small measure to the failure of that country to become grassed.

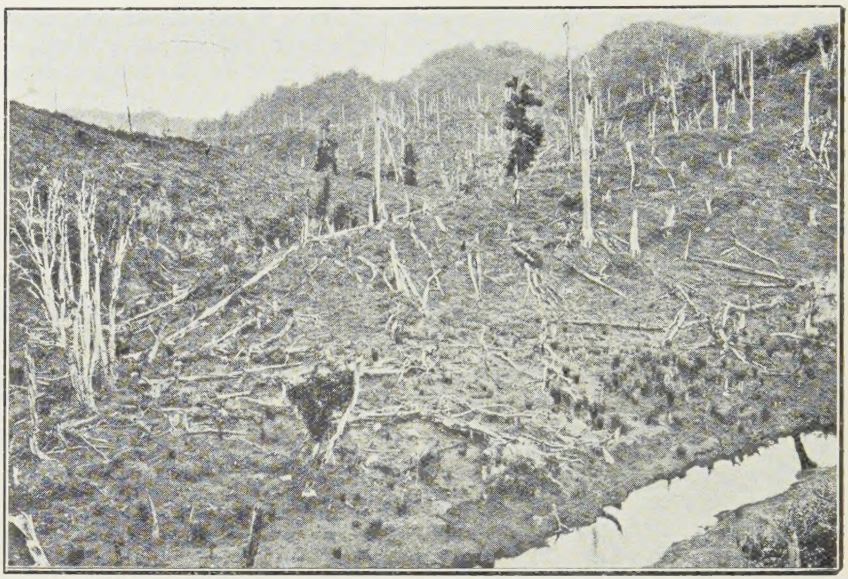

FIG. 44. EASY SLOPING FOOTHILLS, WITH STEEPER SLOPES RUNNING TO BEECH RIDGES IN THE BACKGROUND.,

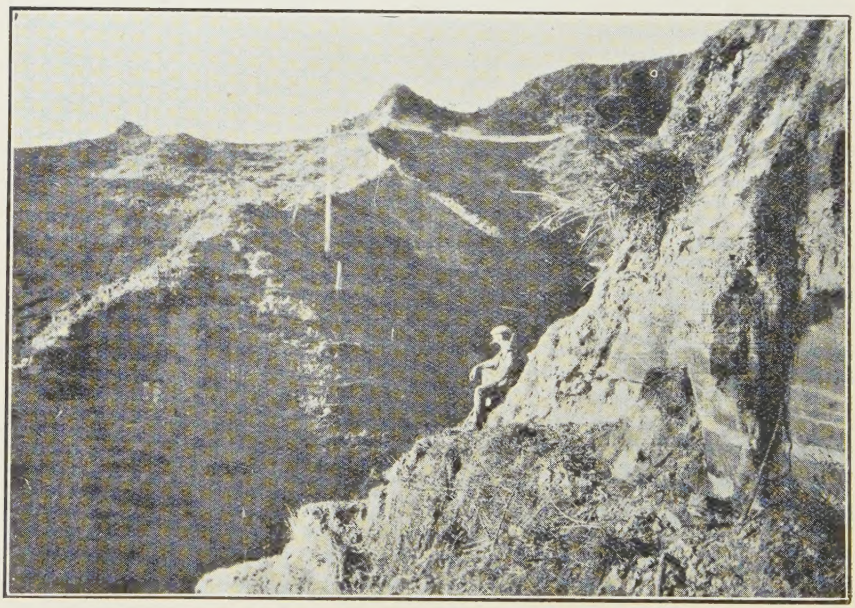

FIG. 45. SHADY SLOPES AND SUNNY SLOPES: PAPA AND SANDSTONE OUTCROPS.

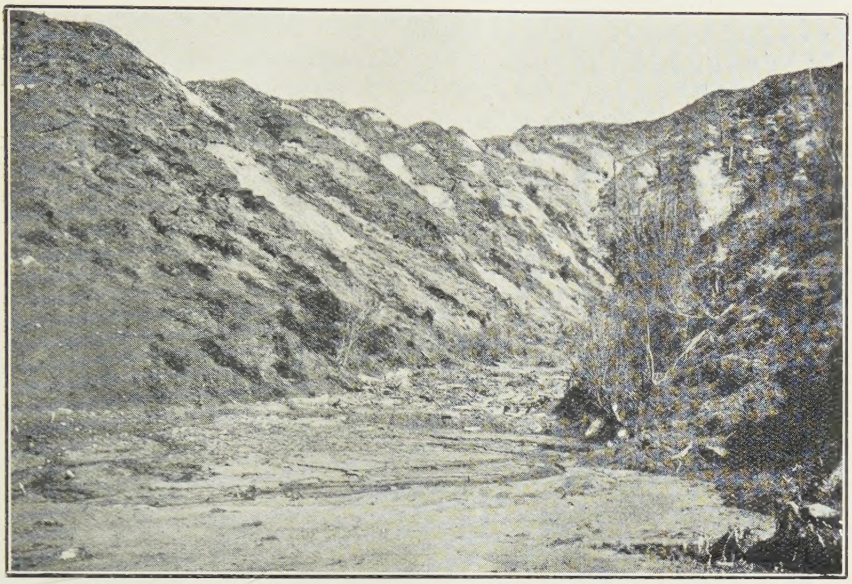

FIG. 46. SLIPS AFTER HEAVY RAIN, PRESENTING A VERY DIFFICULT SEED-BED.
In the foreground is a swampy area newly formed from debris from the hills and slips.

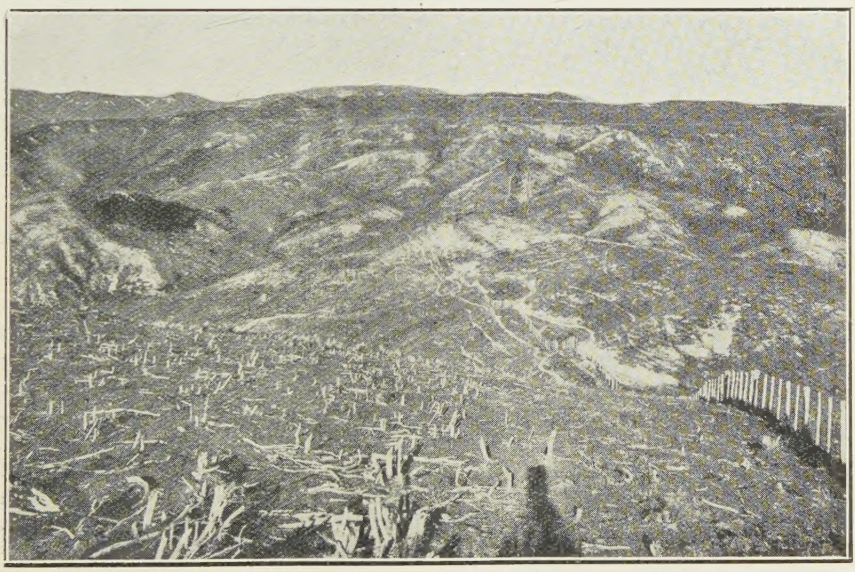

FIG. 47. IN BACKGROUND, HARD FACES WITH STUNTED MANUKA BURN, WHERE THE SEED-BED IS ALMOST HOPELESS FOR MUCH RESULT FROM ANY SEED SOWN.
[*Photos by E. B. Levy.*

MAJOR DEVELOPMENTS ON HILL COUNTRY FROM THE INITIAL PRIMARY BURN.

Viewing the hill country of New Zealand as a whole, we find that the development has taken four very definite courses from the initial primary burn (Fig. 48).

In the first case the forest has been felled and badly burnt; the burn is unfenced and trackless, prohibiting stock from working over it. Here development in a few years after the burn results in a mass of fern and scrub growth — the initial stages of forest-regeneration (Fig. 49).

FIG. 48. A PRIMARY FOREST BURN.

From this stage four major developments in the history of hill-country grasslands have taken place. [*Photo by E. B. Levy.*

In the second case (Fig. 50) the development has also resulted in secondary growth—bracken fern, hard fern, manuka, &c.—but after a profitable grassland period varying from six to ten years. The grasses sown were in the main first-class English grasses and clovers—rye-grass, cocksfoot, Poa pratensis, timothy, red and white clover, &c.—which kept going well until the reserve plant-food of the forest burn was used up. With a reduction in fertility these gross feeders were not adequately nourished, and a dwindling of each grass took place, resulting finally in the production of a weak, open turf. With a much reduced carrying-capacity stock could no longer be maintained on the areas in sufficient numbers to control the secondary growth, which gained rapidly on the weak, open turf. Once such growth established and stock withdrawn, it was a matter of a short time only before the

practical annihilation of the weak pasture-plants was accomplished. This second development — primary forest burn, good grass for a period, weak, open turf, and finally secondary growth — is fairly characteristic of the wetter portions of the west coast of both the North and South Islands.

The third development—perhaps the major development—on hill country in New Zealand is characterized by the formation of a permanent grass cover formed largely by species other than those sown in the original mixtures applied to the forest burn, but which have come in later, unbidden as it were, as soon as the first-class grasses sown weakened and the turf opened up (Fig. 51). We see in these two latter developments a similarity for the first six to ten years—rye-grass, cocksfoot, &c., following the burn, a corresponding decrease in fertility, and a similar weakening of species and opening-up of the turf. At the weak, open-turf stage the development forks. In the one direction we get an encroachment of secondary growth, and in the other the development of a grass turf formed by hardier, second-rate grasses and clovers, such as danthonia, brown-top, paspalum, ratstail, suckling-clover, &c. This latter development is characteristic of the somewhat drier hill country of the east coast and northern part of the North Island, and of the north of the South Island. It is also fairly characteristic of farms within the secondary-growth zone where the farmer had a sufficiency of stock to crush out such growth whenever it put in an appearance. Temporary phases of secondary growth also often characterize the development to hardier grasses (danthonia, brown-top, &c.), but the elimination of this growth is made very much easier by the ability to burn.

The fourth development on hill country—unfortunately, over only a comparatively small area — has consisted in a slight reduction of the first-class grasses and virtually no development of secondary growth (Fig. 52). About Mangaweka and Taihape, in the Rangitikei County, and on certain more favoured areas in Hawke's Bay and in the Wairarapa, may still be seen hill country holding the majority of the English grasses sown—cocksfoot, Poa pratensis, white clover, and a fair sprinkling of rye-grass. The turf—at any rate, where at all well managed — has remained sufficiently closed to prevent the entrance of either secondary growth or the hardier grasses (danthonia, brown-top, &c.). Even on this good hill country, however, where hard continuous grazing characterizes the farming, danthonia is making rapid headway (Fig. 53).

From the experiences, then, of the past we come to the following conclusions regarding the grassing of hill country :—

(1.) Where the soil is sufficiently strong and conditions are fairly easy there is no secondary growth and scarcely any appearance of the inferior, hardier grasses and clovers.

(2.) Where the soil has lost its original fertility, or where conditions are hard, the development has been either to secondary growth or to hardier grasses and clovers.

(3.) The appearance of weak turf, secondary growth, or inferior grasses is a certain indication of conditions too hard for the better English grasses and clovers. For these to become dominant again conditions must be made easier and surface fertility built up. Where

FIG. 49. FIRST DEVELOPMENT: PRIMARY BURN TO SECONDARY GROWTH WITHOUT ANY PROFITABLE GRASSLAND PERIOD.

In foreground, new felling ready for the match; on right, the primary forest; on left, a block of reverted country.

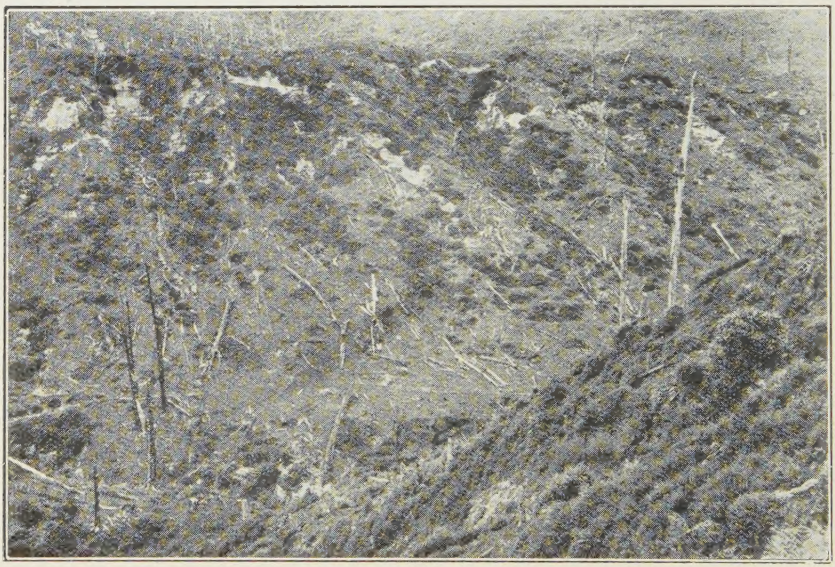

FIG. 50. SECOND DEVELOPMENT: PRIMARY BURN TO SECONDARY GROWTH AFTER A PROFITABLE GRASSLAND PERIOD OF ABOUT FIFTEEN YEARS.

Hard fern on slopes in middle distance and foreground induced by close and continuous grazing with sheep.

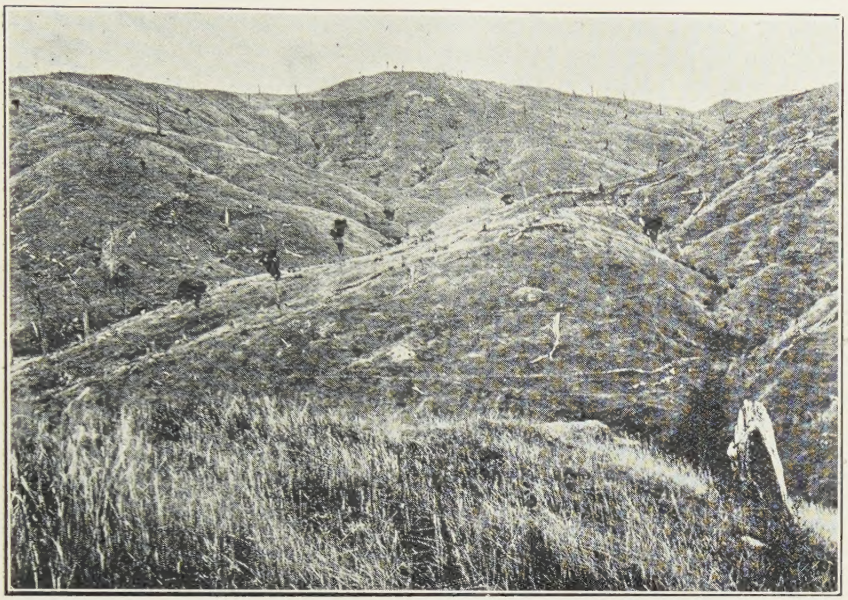

FIG. 51. THIRD DEVELOPMENT: PRIMARY BURN TO PERMANENT GRASSLAND OF A NATURE DIFFERENT FROM THAT SOWN OR INTENDED.

Danthonia and brown-top turf mainly; on hill country in the Wairarapa.

FIG. 52. FOURTH DEVELOPMENT: PRIMARY BURN TO PERMANENT GRASSLAND, RETAINING LARGELY THE ORIGINAL SPECIES SOWN.

Area in southern Hawke's Bay.

[*Photos by E. B. Levy.*

fertility cannot be economically built up and conditions cannot be eased, inferior, hardier grasses are the only alternative for hill country.

It will be patent in this series of articles that the writer lays a great deal of stress upon management—upon the type of management, upon the ability to maintain fertility, upon the ability either to spell or to crush at set periods, and upon the class of stock grazed on the pasture. Each has an important bearing on just which grasses and clovers or what set of secondary-growth weeds are to become the dominants on the particular country. No species of grasses and clovers, no application of artificial manures, are of any avail without carefully managed stock. Thousands of acres of hill country have been burnt and sown, but owing to the inability to stock at the right

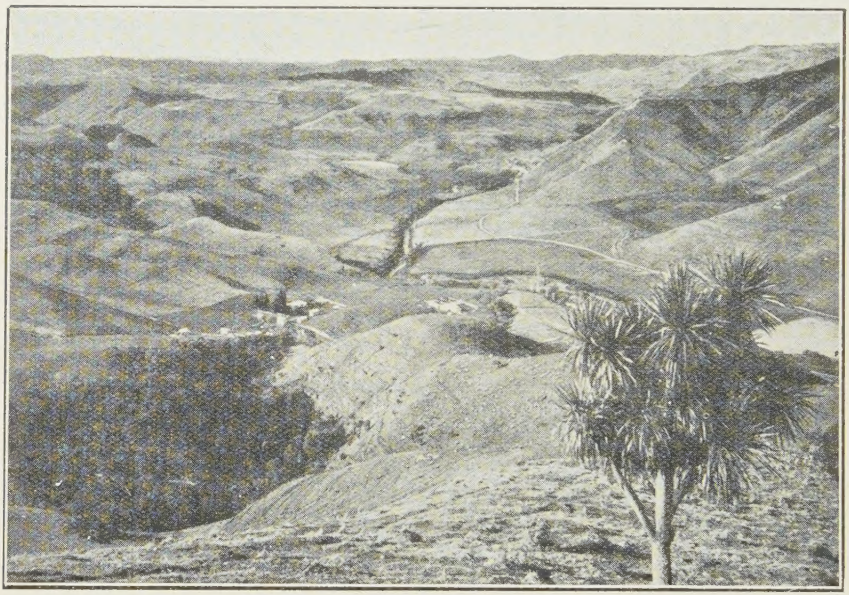

FIG. 53. PART OF RANGITIKEI COUNTY (MOHANGA) WHERE DANTHONIA IS COMING INTO COUNTRY THAT SHOULD STILL BE CARRYING A LARGE PROPORTION OF RYE-GRASS.

[Photo by E. B. Levy.

time have reverted once more to fern and scrub. It were infinitely better that the money had never been spent on seed under such management, for not only is there the direct financial waste, but there also follows loss of heart in the worker and loss of confidence in the country by the settler. The wetter the climate the truer becomes this truth—that grass-seed sowing or manurial top-dressing go for nought without the judicious management of stock. In drier districts where burning can be regularly carried out the stocking factor is not so important, for here the removal of the shade of secondary growth is easily accomplished by fire before the growth gets sufficiently dense to kill out the grass. It must be borne in mind that the ultimate value of stock, particularly cattle, is to crush out secondary growth, so that plenty of light may reach to the ground-surface to give strength and life to the pasture.

GRASSES AND CLOVERS USED IN HILL PASTURES.

There are in the main a dozen or so grasses and clovers that are most commonly used in hill-country pastures—namely, perennial rye-grass, cocksfoot, crested dogstail, Poa pratensis, paspalum, brown-top, Danthonia pilosa, ratstail, white clover, Lotus major, suckling-clover, English trefoil, subterranean clover, Lotus hispidus, and yarrow. On really first-class forest country certain additional species may be used in small quantities, these being meadow-foxtail, Poa trivialis, timothy, alsike, and red clover. From what has been said it will be seen that according to conditions of soil, aspect, and management so will one or more of these species predominate. In no hill country do we find the whole of these species equally mingled together, although on any one tract each may dominate over a more or less localized area within that tract of country. In the past the farmer in choosing species for his hill country has been very apt to choose those species that he would like to see present on his farm, rather than those that the country can support. Cheapness of seeding, bulkiness for sowing, rapidity of establishment, and early production have been big factors also in influencing the choice of species.

It is hoped that the following short account of the different species for hill country will add somewhat to the farmer's knowledge, and will thus enable him to spend money to better advantage in the buying of seed.

(1.) Perennial Rye-grass (*Lolium perenne*).

In the early days of the breaking-in of hill country, in the North Island particularly, perennial rye-grass as a dominant in the mixture was almost universal. In the mid-west back-country the argument waged not about whether the country should be sown with hardier grasses, but whether it should be sown with rye-grass or cocksfoot, many settlers arguing that the country was too good for cocksfoot. Any advocate of the hardier grasses, such as danthonia, fifteen to twenty years ago in Taranaki or in the King-country would most probably have been regarded as insane and a menace to the district.

Perennial rye-grass is the farmer's ideal in many respects. The seed is cheap and easily procured; it is bulky and nice and easy to sow; it does not cling to the sacks or clothes of the sower; it is easily spread, being visible on the ground, and quite a good area of ground can be covered at each cast; the seed germinates readily, and its establishment is rapid and certain, and quite early there is a good growth of palatable herbage. The great failing of rye-grass, however, is that it does not hold, excepting under very special conditions (Figs. 54 and 55).

The strong early growth of rye-grass on hill country is due to the plentiful supply of plant-food present in the humus of the forest-floor and ash of the primary burn. As soon as this supply becomes exhausted the rye-grass dwindles and "goes out" as far as being a feed-producer is concerned. This weakening of rye-grass and subsequent opening-up of the pasture sward is the first stage of deterioration in hill-country pastures.

FIG. 54. FAILURE OF RYE-GRASS ON HARD KNOLL ON PRIMARY BURN FOUR YEARS OLD.

Hard fern and weeds are here taking possession.

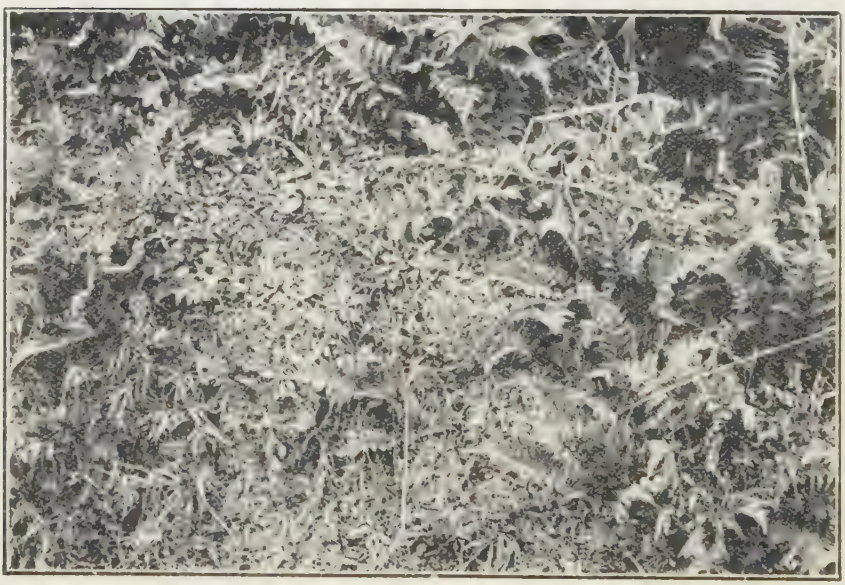

FIG. 55. FAILURE OF RYE-GRASS ON SECONDARY BURN.

Close view on a hard-fern burn, showing the ground run largely to catsear, and hard fern rapidly spreading again.

[*Photos by E. B. Levy.*

For perennial rye-grass to thrive there must be a plentiful supply of available plant-food in the soil; hence the range of rye-grass on any hill-country farm is limited to those areas of high soil-fertility. The more general this high state of fertility the more general will rye-grass be in the pasture. Conversely, the more restricted these areas of high soil-fertility the more restricted becomes the rye-grass.

An examination of the pastures on any hill country will bear out this statement, and will show very clearly the position rye-grass occupies at the present time on old grassed hill country. We may start with the holding-paddock (Fig. 56), which, as will be commonly agreed, is generally the most highly fertile piece of land the hill-country farmer possesses, fertility from the hills being conveyed there and deposited by sheep and other stock concentrated there at different times. The following point analysis of a holding-paddock twenty-five years old, on the farm of Mr. A. Coxhead, Whangamomona, tells clearly and accurately what the predominant grass is:—

Point Analysis, Small Holding-paddock, A. Coxhead, Whangamomona, 16/5/25.

	Percentage of Ground-area occupied.
Bare ground	1·2
Perennial rye-grass	48·8
Cocksfoot	16·0
White clover	12·0
Poa trivialis	6·0
Poa pratensis	2·5
Suckling-clover	1·0
Yorkshire fog	2·0
Brown-top	0·4
Danthonia pilosa	0·2
Yarrow	1·0
Poa annua	1·3
Weeds	7·0

In this analysis it will be seen that perennial rye-grass forms just about half the total cover, and this species, together with other first-class grasses and clovers, comprises some 85 per cent. of the entire sward. Bare ground occupies only a little over 1 per cent.

If now we go from this holding-paddock through the fence shown in Fig. 56 we come to a larger holding-paddock where, owing to a lesser concentration of stock, the fertility is not maintained to so high a standard. The state of this pasture is shown by the following point analysis:—

Point Analysis, Large Holding-paddock, A. Coxhead, Whangamomona, 5/6/25.

	Percentage of Ground-area occupied.
Bare ground	10·0
Perennial rye-grass	24·0
Cocksfoot	14·3
Poa pratensis	10·0
Yorkshire fog	9·7
Poa trivialis	7·6
Suckling-clover	6·0
White clover	1·0
Crested dogstail	0·3
Danthonia pilosa	0·3
Poa annua	1·0
Timothy	0·5
Weeds	15·3

FIG. 56. HOLDING-PADDOCKS ON FARM OF A. COXHEAD, WHANGAMOMONA.

Small paddock is shown in foreground, and large paddock through fence in background.

FIG. 57. STOCK-TRACK ON HILLSIDE.

On left, weak, open turf; on right, brown-top mainly; in centre, rye-grass dominant on the track itself.

[*Photos by E. B. Levy.*

Here, then, we see under a lower state of fertility a reduction in the amount of perennial rye-grass, and a noticeable increase in the amount of weeds and bare ground.

Again, tracks on hillsides are usually more fertile than the general slope, and along such tracks rye-grass usually predominates irrespective of what grass is growing on the general slope (Fig. 57). Consolidation and treading by stock favour extremely the growth and persistence of rye-grass, but it must be borne in mind that these factors are generally accompanied by a fertility-increase due to the manure deposited while the treading and consolidation processes are going on. Congregating-places for stock (Fig. 58), foothill slopes and ridges where one finds stock camps, are also generally fertile, and here, again, rye-grass becomes a dominant. These stock camps on ridges, where the soil is usually scanty, show that with the maintenance of a high surface-soil fertility there is little need for depth of soil to ensure persistence and a satisfactory growth of rye-grass. Fig. 59 shows perennial rye-grass growing vigorously on not more than 1 in. depth of soil overlying a hard sandstone outcrop. This portion of the ridge was used as a sheep camp.

On the foothills and easier slopes one can generally find a fair sprinkling of rye-grass. In certain parts of the better hill country in Rangitikei and Hawke's Bay it may even extend a good distance up the slopes, its extent always being defined, however, by the limits of richer soils.

In the Taranaki back-country, wherever the surface soil has become depleted, one finds the following position in regard to perennial rye-grass in the pasture:—

Point Analyses, Old Pastures, on General Slope where Fertility has become considerably depleted.

	Easy Foothills, J. Ostler, Kohuratahi, 20/6/25.	General Slope, C. Carter, Tahora, 8/5/25.
	Percentage of Ground-area occupied.	Percentage of Ground-area occupied.
Bare ground	16·5	17·2
Perennial rye-grass	4·4	3·9
Cocksfoot	9·9	8·4
Poa pratensis	10·4	5·0
White clover	4·4	1·6
Yorkshire fog	17·2	7·7
Catsear	16·1	20·2
Suckling-clover	7·6	2·8
Sweet vernal	..	16·1
Crested dogstail	0·2	..
Timothy	0·2	0·2
Selfheal	9·7	5·4
Danthonia pilosa	..	0·8
Chewings fescue	..	1·1
Other weeds	3·4	10·0

As a feed-producing constituent in the above pastures it can be said that rye-grass is of very little value. Analyses made on harder and poorer slopes than these show even a greater decrease in the amount of rye-grass present; but the analyses given are sufficient to show that under poor, hard soil conditions rye-grass after a few years dwindles to insignificance as a feed-producer in the pasture.

FIG. 58. CONGREGATING-PLACE FOR STOCK ON FAIRLY EASY FOOTHILL, WITH RYE-GRASS LARGELY IN EVIDENCE.

The general slope is mainly danthonia and New Zealand rice-grass. Location, Wairoa, Hawke's Bay.

FIG. 59. PERENNIAL RYE-GRASS GROWING VIGOROUSLY ON SOIL NOT MORE THAN 1 IN. DEEP.

The surface fertility here is extremely high, the area being used by sheep as a camp. On right is the bare sandstone outcrop, which underlies also the rye-grass sward.

[*Photos by E. B. Levy.*

It will be seen, then, that perennial rye-grass persists and grows strongly on hill country only where the soil is naturally very fertile or where the soil-fertility has been maintained at a high standard through the influence of stock. If more stock can be maintained (not starved) on an area by inbrought stock-foods or by promoting a general higher-production pasture by top-dressing with artificial manures, then would be found an enlargement of stock camps, more consolidation and treading, more tracking of the slopes, and hence a greater proportion of rye-grass throughout the pasture (Figs. 60 and 61).

A surprising feature of grassland is the manner in which species once sown and established persist in the pasture sward, even under a very low state of soil-fertility and in competition with low-production, hardy pasture-plants. If one refers to the pasture analyses on page 305 it will be noted that after twenty-five years, under a very much reduced fertility, there is still a small percentage of the better elements persisting as vestiges in the sward. Perennial rye-grass is noteworthy in this respect, and upon this fact depends the return of rye-grass in pastures once fertility is sufficiently increased.

PERENNIAL RYE-GRASS UNDER SHADY CONDITIONS.

Perennial rye-grass will not endure shade, and as a competitor against rank cocksfoot or secondary growth it is an utter failure. With regard to the hill country, the inability of rye-grass to endure shade limits its usefulness to some extent, but with secondary growth predominating it generally means that soil conditions have become too hard for rye-grass to thrive well. Strong-growing rye-grass, reasonably well stocked, will compete with any secondary growth, but once it weakens and secondary growth puts in an appearance it is soon subdued by the shade such growth casts.

PERENNIAL RYE-GRASS IN PRIMARY AND SECONDARY BURNS.

From what has been said it will be seen that perennial rye-grass has its limits and shortcomings on hill country, and the question is to what extent should it be sown on primary and secondary burns.

There is no argument against the use of perennial rye-grass on the primary burn (Fig. 62). The soil-fertility is present, and the early feed secured from the rye-grass goes a long way in the first year or two towards paying the felling and seeding expenses of the burn. Its rapid growth enables an early stocking of the burn, which is necessary in the control of secondary growth, and a good sward of grass from the outset certainly limits to some extent the very large growth of Scotch thistle now almost universal on primary forest burns. On primary burns of the Taranaki back-country, at any rate, one has to be careful not to let rye-grass dominate the mixture to the exclusion of some at least of the finer seeds and hardier grasses. On the average slopes 6 lb. to 8 lb. per acre of perennial rye-grass in the mixture is sufficient.

With regard to secondary burns, it is just a toss-up whether perennial rye-grass should be included or not. If sown in the early autumn

FIG. 60. HILLSIDE AT WAIROA, USED AS A RUN-OFF PADDOCK FROM THE FLAT BELOW (NOT SHOWN).

Fertility of the flat transferred by stock raised the fertility of the hills sufficiently to promote a strong growth of rye-grass.

FIG. 61. CLOSE VIEW OF TURF JUST BEYOND FENCE ON LEFT OF FIG. 60, WHERE NO FERTILITY-INCREASE HAS BEEN EFFECTED.

The rye-grass is extremely stunted and weeds are becoming dominant.

[*Photos by E. B. Levy.*

certainly rye-grass does give a quick bite during the following winter, particularly on heavy bracken and heavy manuka burns. The guiding principle, the writer thinks, in the use of perennial rye-grass in secondary burns is whether the rye-grass in the first two years will give sufficient feed to pay for its inclusion in the mixture, bearing in mind always that unless some system to increase and maintain fertility be adopted the perennial rye-grass is not going to remain an important permanent element. A thing that is temporary must recoup itself rapidly to justify its inclusion or use. A species that is going to remain permanently need not pay for its inclusion in the first year or so. From analyses made of sowings on secondary burns at Whangamomona it would appear that perennial rye-grass in the first year was about fourth on the list of species as far as cheapness of cover was

FIG. 62. PERENNIAL RYE-GRASS AS A DOMINANT ON A PRIMARY BURN.
Farm of Murphy Bros., Aotuhia, Whangamomona County.
[*Photo by E. B. Levy.*

concerned. In mixtures for secondary-growth burns it is imperative that the seeding should not be expensive. The cheapening of the sowing by using mainly perennial rye-grass is a disastrous course to adopt; in fact, the inclusion of perennial rye-grass should only be considered after the settler has available sufficient money to pay for the inclusion in sufficient quantities of the more important elements of the mixture. Perennial rye-grass, therefore, cannot be regarded as an integral part of mixtures for the sowing of secondary burns, but its inclusion in the mixture may enable a higher winter carrying of stock on the new burn for one season. Whether or not this early production and winter stocking of a new secondary burn is advisable still remains to be proved; 2 lb. to 4 lb. of perennial rye-grass per acre is sufficient to include in the mixture for any secondary burn.

SUMMARY.

From the foregoing it will be seen that perennial rye-grass on the hill country has sadly declined from major rank during the past twenty-five years, and that unless steps are taken to replace the annual loss of fertility that goes off the farm in wool, mutton, lamb, milk, and beef the dwindling process of rye-grass will go on—more and more openings in the pasture affording easy ingress for weeds or other species of grasses. The country which carried rye-grass for a few years only should see it no more, the expense of raising that soil to rye-grass standard probably being too high. The soil, however, which has carried rye-grass for the last twenty-five years or so, but which is now running

FIG. 63. PASTURE TWENTY-FIVE YEARS OLD, IN THE APITI DISTRICT, SHOWING SPINDLY RYE-GRASS AND WEEDS (CATSEAR MAINLY) INVADING THE WEAK TURF.

Liberal top-dressing would bring this country back to rye-grass.

[*Photo by E. B. Levy.*

to inferior grasses or weeds (Fig. 63), should be top-dressed by hand to win it back once more to rye-grass. Strong-growing perennial rye-grass cannot be surpassed for production, and the more of it the farmer keeps in his pastures the more credit is due to his farm-management. This, however, will not be secured by simply sowing: it must be well managed and liberally fed.

NOTE.—Point analyses quoted in this article were made by the writer's assistant, Mr. E. A. Madden

(Series to be continued.)

Noxious-weeds Orders.—The Wairoa County Council has declared foxglove, Bathurst burr, and variegated thistle to be noxious weeds within that county.

DETERRENT SPRAYS FOR PEAR-MIDGE.

FURTHER EXPERIMENTS AT HENDERSON.

R. H. MAKGILL, Henderson, Auckland.

IN the *Journal* for April, 1925, the writer gave some account of the use of nicotine with an oil carrier as a spray intended to deter the female midge from depositing its eggs in the young leaves of the pear. Further experiments were conducted in the spring and early summer of 1925. The results, however, are somewhat obscured by the fact that the midge this season failed to appear at the usual time. Previously midges have been caught between 1st and 6th October. In 1925 none was detected till 11th October,* and the first signs of infestation of pear-leaves were not evident till the 18th, whereas in former years these signs showed themselves from the 10th to the 13th of that month. Possibly this was the result of the cold weather and frequent rain experienced during September. The result was satisfactory from the pear-growers' point of view, since this delay enabled varieties such as Beurré Bosc and Bon Chretien to set their fruit and develop a fair covering of leaves before the midge got to work. Larger crops and better growth than in any year since the midge became prevalent was the result even on trees which received no deterrent sprays, and this was the experience of most orchardists in the Henderson district. It is therefore necessary to exercise caution in drawing conclusions from the apparent results of the sprays tested.

European observers have reported satisfactory results from the use of naphthalene as a means of keeping insects off plants, so the writer decided this year to give it a trial. In a series of articles in the *Journal of Pomology* R. M. Woodman describes experiments testing various methods of making emulsions and suspensions. In that publication for January, 1925, he reports most favourably upon gelatine (or size) as a means of suspending solids in spray solutions, and mentions that in wet weather the leaf-surfaces sprayed with gelatine were not washed clear of spray, but became sticky, so that the suspended solids were more adherent. As the sprays tried in previous years against midge seemed to lose power after wet weather it was also decided to test the value of glue (size) as a suspensory agent. The following are the details of the experiments :—

NICOTINE WITH OIL SPREADER.

In the previous article mention was made of a spray with Black Leaf 40, 1 in 800 parts, and a mineral oil (sold as Olene) as the spreader, in a strength of 2 per cent.

In 1925 ordinary spraying-oil at a strength of 1½ per cent. was substituted for the Olene, and this spray was applied on 4th October

* A simple method of detecting this midge is to examine the contents of spiders' webs in the trees. By using a piece of glass smeared with glycerine these webs can be collected and the captured insects examined.

to a block of eighteen three-year-old pears of mixed varieties. As a result a certain amount of leaf-scorch was produced, especially in some varieties, and the use of oil was not repeated.

NICOTINE WITH SIZE AS SUSPENSOR.

In his experiments at the Horticultural Research Station, Cambridge University, Woodman found that gelatine in a proportion of 3 lb. to 100 gallons of water was an effective suspensory agent for arsenate of lead. This proportion was therefore adopted by the writer, ordinary painter's size being used instead of gelatine. Nicotine sulphate, in the form of Black Leaf in the ratio 1 in 800, was stirred into this glue solution, some soap-powder—½ lb. in 100 gallons—being added owing to the hardness of the water from the deep bore well supplying the orchard. This mixture was applied to the block of eighteen three-year-old pears already mentioned and to four well-grown Beurré Bosc pear-trees on the following dates: 14th and 25th October and 1st and 7th November. Thereafter naphthalene was added to the mixture, as will be described in a subsequent paragraph, but prior to this change the nicotine-glue spray proved effective in reducing the attacks of the midge. Thus on 1st November, while the unsprayed trees throughout the orchard showed midge-infestation on practically all the growing tips, with the usual resulting blackening of the infected leaves, the young three-year-old trees were practically free, perhaps five or six curled leaves on each tree being the only evidence that midge was present. From the date on which these few infected leaves began to blacken it was possible to deduce that the eggs were laid about 23rd October. Had the original intention to spray every seven days during October been carried out it is possible that even this slight attack would have been avoided. Probably the effects of the spraying began to wear off towards the end of the eleven days which intervened between the spraying on 14th October and that on 25th October.

By 14th November, when the composition of the spray was altered, these young trees still showed a satisfactory freedom from midge-infestation, with the exception of one variety (L'Inconnue) on which a fair number of affected leaves were found—not, however, sufficient to check the growth of the new shoots.

In regard to the adult Beurré Bosc trees, the results of spraying were not so evident. Most of the young shoots showed a certain amount of infestation by 14th November, but it was certainly less than on the trees which had not been sprayed. These trees were too large to be very effectively treated by the hand-pump with which the experimental spray-mixtures were applied. Possibly the use of a power-spray machine would have given better results. One satisfactory feature, however, was the noticeable reduction in damage from bronze-beetle evident on all the trees, both young and adult, to which the nicotine-glue spray was applied. Even the tips of the tallest trees showed few ragged damaged leaves, and on the smaller, more accessible trees this freedom was more pronounced.

APPLICATIONS OF NAPHTHALENE.

Naphthalene appears to have no injurious action on plants. It has been applied in various ways by European observers to drive off insects. Taschenberg advocates hanging rags soaked in naphthalene

in the branches of apple-trees to keep away codlin-moth. A dusting-powder formed of one part naphthalene to nine parts of sulphur is used to prevent the female cochylis from laying its eggs on the vine. Mixed with lime, it is applied to the soil to destroy ants, crickets, cockchafers, and so on.

To test its effect on the pear-midge small muslin bags filled with naphthalene were hung in the branches of two P. Barry trees, and it was found that in an area about 8 in. or 10 in. from the bags no leaves were attacked by the midge. The only form in which the writer was able to get naphthalene was the ordinary "moth-ball." These had to be crushed to a fine powder in carrying out the various trials. For the future, arrangements have been made with a firm importing chemicals to obtain it in finely powdered form.

It was somewhat difficult to determine the most suitable method of applying the naphthalene, which is insoluble in water and not readily soluble in alcohol or paraffin.

NAPHTHALENE AND SPRAYING-OIL.

Kerosene and spraying-oil dissolved naphthalene in a proportion of about $\frac{1}{2}$ lb. to the gallon, but for a summer spray not more than $1\frac{1}{2}$ per cent. of spraying-oil can be used with safety. Thus the proportion of naphthalene reaching the leaves is extremely small if such a solution be used. It was applied to fifteen young P. Barry pears and two fully grown Bon Chretiens on 4th October, and again on 14th October. It was so far effective that by 25th October, when unsprayed trees showed fairly severe infestation by midge, these P. Barrys were practically free, and there was little to be seen on the Bon Chretiens. However, there was a noticeable amount of leaf-scorch from even so small a proportion as $1\frac{1}{2}$ per cent. of the oil, so this method of carrying naphthalene was abandoned.

NAPHTHALENE AND SULPHUR DUSTING.

Powdered naphthalene, being somewhat inclined to cake, is not a very suitable material for dusting unless mixed with some light non-caking powder. Sulphur-flour was found to be suitable, and as such a mixture has been used in Europe it was tried on three young P. Barry pears, the proportion being one part of naphthalene to two parts of sulphur. To ensure adhesion of the dust the trees were sprayed before dusting with a solution of 3 lb. of size in 100 gallons of water. This was applied on 14th and 25th October, and 1st and 7th November.

On the latter date the dusted trees were practically free from midge-infection, and afforded a marked contrast to some Beurré Diel trees alongside them which had been treated in another manner, to be described presently. It is probable that the naphthalene was the most active agent in keeping off the midge, but sulphur is also to some extent a deterrent to insects. However, by the first week in November it was noticed that the dusting was having a deleterious action on the leaves, which were dark in colour, somewhat dry and leathery, with a tendency to curl at the edges. It is known that in sulphuring vines there is a danger of scorching the leaves if it is done in hot sun, and probably this was what took place with the pear-leaves. The method was therefore abandoned.

NAPHTHALENE POWDER SUSPENDED IN SIZE SOLUTION.

It was found that 10 gallons of a solution containing 0·3 lb. of size would carry in suspension 1 lb. of finely powdered naphthalene. It required frequent stirring, but if this were done there was little choking of the spray-nozzle. It was decided that, since both naphthalene and nicotine had power to hamper the activities of the midge, these two substances should be combined. Therefore from 14th November all sprayings were done with a mixture containing, in 10 gallons, 5 oz. size, 2 oz. (1 in 800) Black Leaf 40 and 1 lb. naphthalene powder. A small quantity of soap-powder was added also, as already described when dealing with the nicotine spray.

This was applied to the young pears hitherto treated with nicotine alone, to the P. Barry pears hitherto treated with dusting or with naphthalene in oil, and to four adult Beurré Boscs and two adult Bon Chretiens. The dates of spraying thus were 14th, 21st, and 28th November, and 4th, 12th, 19th, and 25th December. It was found that this spray had no harmful action on the leaves, and the P. Barry trees which had been checked by the dusting put out healthy new growth. Even so delicate a foliage as that of the peach-tree was not affected by this mixture.

For a time this spray was effective against the attacks of pear-midge. On 28th November the untreated pear-trees throughout the orchard showed widespread infestation, yet the eighteen young pears which had been under treatment throughout the spring and the P. Barry trees had a new growth of from 2 ft. to 4 ft., well clad with undamaged leaves. A few curled leaves were to be found, but not enough to affect the growth.

With the adult trees the benefit was not so marked. They had a good covering of leaves and a satisfactory setting of fruit, but owing to the late appearance of the midge most of the last trees which had not been treated also showed these features. The foliage on the sprayed trees was on the whole better than the average, but was not better than the best of the unsprayed ones of the same varieties. It was satisfactory, however, to find that the setting of fruit was good, from which one could conclude that the spraying had not affected the work of the bees in pollinating.

With the young trees in so satisfactory a condition at the end of November it was disappointing to find that during the first week in December a heavy infestation developed, just as had been the case in previous years. It may be that towards the end of November, when the flights of midge are continuous, the available young leaves throughout the orchard were mostly already infested, and that the female midges were compelled to use the sprayed trees, repugnant though they may be. In the past season there were no specially heavy rains about 27th November (the probable date of infestation) to wash off the spray, nor very hot sun to cause evaporation of the nicotine and naphthalene. The failure of immunity would seem to be due to greater activity on the part of the midge at the period in question.

After 4th December, despite weekly spraying, little new growth formed on the trees till the autumn, when the midge was becoming quiescent. The sprayings were not continued after 25th December.

CHLORIDE OF LIME AS A DETERRENT.

Chloride of lime—or, rather, bleaching-powder—by reason of its property of giving off acrid fumes of hypochlorous acid, is so offensive a substance that it was thought that it might be effective against the midge. Nine well-grown Beurré Diel pear-trees (a variety very readily attacked by the midge) were selected for trial. The bleaching-powder was applied in three ways: (1) Sprayed in a solution containing in 10 gallons water, ½ lb. chloride of lime, and 5 oz. size as a carrier; (2) dusted round the roots of the trees; (3) hung in trays in the branches of the trees.

These applications were made to various trees on 4th and 14th October. The spray did no damage to the leaves, but the dust, where it happened to touch the foliage, caused immediate death of the leaf. It also destroyed all weeds growing under the trees, and later was used with some success in checking the growth of blackberries. However, bleaching-powder proved quite useless as a deterrent of the midge. Infested leaves were found close up against the trays hung in the branches, where the odour of chlorine must have been very strong. On 18th October, four days after the second application, the effects of the midge attacks were evident—indeed, these Beurré Diels were the first trees in the orchard to be infested, and by 25th October, when the trees treated with nicotine and with naphthalene were quite free, these Diels were widely and severely attacked. The use of chloride of lime was therefore stopped.

CONCLUSIONS.

From the results of the experiments in 1925 and previous years the writer is satisfied—

(1.) That nicotine and naphthalene each are effective deterrents of midge-infestation during October and November.

(2.) That towards the end of November and in December the activities of the midge are such that these deterrents become of little use.

(3.) Size forms an excellent carrier for nicotine and naphthalene, and these substances can be combined in a spray which will not damage foliage.

(4.) There is a risk of leaf-scorch from the use of spraying-oil in the spring even at so low a proportion as 1½ per cent.

(5.) Repeated dusting with sulphur has a harmful effect on the leaves of the pear.

It seems possible that by the use of the nicotine and naphthalene spray, applied weekly during October, bearing trees may have a chance to establish a good crop of leaves and set their fruit. In 1925 this occurred because the development of the midge was delayed by climatic conditions. One may hope to secure a like postponement of attack by artificial means, and further experiments will be undertaken in this direction. With young pear-trees, by carrying on the spraying throughout November, a fair growth may be established before the midge becomes too active; and although the injury done thereafter in the summer months must be a serious check to the growing tree, at least there will result a degree of progress not to be found in unsprayed trees.

THE CONTROL OF WEEDS.

2. LOSSES OCCASIONED IN PRODUCTION.

A. H. Cockayne, Director of the Fields Division.

The annual monetary losses occasioned by weeds, from the two standpoints of direct expenditure incurred in their suppression and actual loss in production through their presence, amount to a sum far in excess of that currently realized by farmers. There is little doubt that weeds represent, through their influence on the restriction of agricultural production, a loss not less than that experienced through the combined effects of animal and plant diseases. To my mind, in fact, weeds represent, in checking agricultural expansion, the greatest single factor against which the farmer has to contend.

It is not to be expected that it will ever be possible on a practical basis to bring down weed-damage to negligible proportions. All that can be hoped for is that damage which practice shows to be avoidable on an economic basis should be reduced to a minimum. Such is not being done at the present time, and losses from weeds are tending to rise rather than fall, this being without doubt largely due to farmers failing to realize at their true significance the real principles that must govern weed-control in a country where land-acreage is high and rural population low.

Although weeds, especially when they have the legal appellation "noxious" attached to them, are a perennial source of discussion among farmers, it appears strange that there should be so little definite information available as to the monetary damage they occasion, and stranger still is the fact that many plants on the control of which immense sums are being and have been spent are rarely viewed as having any serious potentialities.

To the farmer weeds are of two types. Firstly are those that are causing him personal damage by visibly lowering the production of his land, or visibly increasing his costs of production by direct expenditure; or, again, which have made him adopt cropping and stocking programmes essentially different to those satisfactory were the weeds not present. Secondly are those that may or may not be on his property, but possess a "reputation" as being serious and likely to grievously reduce the selling-value of his land. Very frequently the weeds the farmer views as really serious are those with a reputation, rather than those that are really at the moment causing him appreciable loss. Expenditure quite willingly incurred in the pulling of foxglove on country threatened with complete second-growth invasion, and failure to adopt reasonable methods of second-growth control, is a typical example of reputation rather than actual seriousness governing the weed question.

It is contended that the seriousness of a weed should be viewed from two standpoints—(1) from a consideration of the actual loss and expenditure it has and is occasioning, and (2) from a consideration of its future possibilities in the light of our present known methods of management and control. In general, it can be said that far more stress is laid by farmers on the future possibilities of a weed than

what it is actually doing. Frequently the fact that certain areas, under probably very inefficient management, are infested with some special weed is used as proving that unless the most stringent methods for complete eradication are taken it will overrun and ruin the whole country. The agricultural history of New Zealand has been punctuated with weed scares: Scotch thistle, Californian thistle, sweetbrier, gorse, ragwort, foxglove, and many others have been heralded and acclaimed for a space as the future destroyers of the land.

To-day blackberry holds undisputed sway as the accepted noxious weed *par excellence*. At the recent New Zealand Institute Science Congress at Dunedin I had the temerity to suggest that there were other weeds which were occasioning far greater loss than blackberry. The idea that one would not subscribe whole-heartedly to the contention that blackberry, unless completely eradicated, would turn the whole of New Zealand into an impenetrable blackberry thicket aroused quite widespread indignation in various quarters. Serious as the position is in certain districts of New Zealand through the presence of blackberry, it must be unhesitatingly asserted by any one who has given any real attention to the subject that its menace is not as serious as popular clamour would lead one to believe, provided reasonable steps are taken to protect by proper management the clean and comparatively clean grass areas.

At the Dunedin meeting I claimed that on our grasslands ordinary bracken and hard fern had and were occasioning far greater losses than had blackberry. With this opinion all must agree when it is pointed out that at the present time in both the North and the South Islands there are quite one million acres of ground that have become fern-dominant which when clean were capable of carrying a sheep to the acre. From recent statistics it would appear that the product of an average sheep per year can be put down at £1 6s. Taking this figure as a basis, fern has the unenviable distinction of reducing the production of the country by not far short of one and a half million sterling per year. Certainly blackberry, bad as it undoubtedly is, cannot be justly claimed as causing such very heavy loss. I fully realize that it will be at once said that fern can be controlled on an economic basis, whereas blackberry cannot be thus controlled where the land is of comparatively low value and has become badly infested. The fact, however, that fern, a controllable weed, causes such widespread loss does not alter the fact that, measured in loss of production, it ranks as probably the worst weed of this country.

So far as actual direct expenditure is concerned, I would be inclined to place the members of the twitch family as our most expensive weeds. On a conservative estimate at least three thousand horses, additional to those necessary for normal cultivation, have to be kept for the control of those underground-stemmed plants that come under the farmer's category of twitch. This means that these weeds are causing an annual expenditure of from £150,000 to £200,000 over and above that necessary were they absent. Even with this large annual expenditure definitely increasing the costs of actual production to a very appreciable amount, twitch still remains as a serious reducer of crop-production. It is interesting to note that neither fern (one of the major features of second-growth invasion) nor

the twitches (as the worst weeds of arable land) come within the legal interpretation of "noxious" weeds, and this only indicates that a rather erroneous perspective is given to the weed problem by confining our conception of noxious weeds to those that have been declared so by legislative enactment or local-body order.

In the absence of definite and accurate statistics it is quite impossible to put down any reliable figure as to the total loss in production caused by weeds, but I hazard the estimate that a leakage of quite 10 per cent. flows through their channels. As the value of our total agricultural production cannot be far short of seventy millions sterling such an estimate means an annual loss of seven millions per year. As already stated, it is not to be expected that weed loss can be brought to negligible proportions even by the most skilful of farm-management, but the losses estimated are sufficiently large to emphasize the fact that the most efficient management possible should be adopted to reduce, so far as is economically sound, the undue toll now being paid by our farmers.

A most serious feature of the weed question on our grasslands is that a very considerable area of the land under occupation is made very little use of, being comparatively waste land, but which the holders hope sooner or later to bring into profitable production so soon as the better parts of their holdings are on a stable and permanently productive basis. At the present time, owing to the very small returns derived from such land, it cannot justify any appreciable recurrent expenditure in weed-control. In consequence such areas soon become covered by nature with the vegetation most suited to the soil, aspect, and climatic conditions. In most cases stocking is only irregularly carried out, and when weeds—that are afterwards extremely expensive to control—obtain possession there is the chance that these areas may never pay to break in and will permanently remain waste land. Weeds such as gorse and blackberry are particularly serious on such land, as when they obtain full possession no stocking can be carried out unless at almost ruinous expenditure, and in consequence such areas tend to become not only valueless but a menace by the invasion of neighbouring land of moderate producing-value.

Under the present system of land-valuation farms with considerable areas of what is virtually land of no producing-value are usually valued at too high a price under the assumption that this land later on will have a productive worth. Where such areas are very badly infested with weeds, particularly blackberry, the farmer views them as being a great danger to the rest of his holding, and half-hearted attempts to lessen their spread by burning, cutting, and other methods that are only of transient value are carried out. Such methods of control are wrong in principle and often represent a complete waste of money. The first principle with regard to weeds which, when established, require complete eradication in order to make the land reasonably productive is that the farmer should adopt methods of protection of his clean land, rather than make any direct attack on the areas where the weeds have full possession.

In the past far too much emphasis has been given to the menace that large areas of any particular weed may exercise in the invasion

of clean land, and too little emphasis to the practices that must be adopted in order to keep clean land clean. A better knowledge and better application of the principles involved—all of which are connected with pasture maintenance and improvement—would do much towards the solution of the weed problem in connection with our grasslands.

(To be continued.)

RULES FOR CERTIFICATE-OF-RECORD TESTING OF PUREBRED DAIRY COWS.

CURRENT ADDITIONS AND AMENDMENTS.

W. M. SINGLETON, Director of Dairy Division.

WHEN, in June, 1924, the Dairy Division issued, with considerable amendment and addition, a reprint of the C.O.R. rules, it was believed that the matter had at last reached a stage where the need for any serious alteration was likely to be fairly remote. In so brief a space as two years, however, several important irregularities and weaknesses have disclosed themselves, with the result that it has been considered necessary to commence the forthcoming season with a still more comprehensive set of rules. The new edition is now ready for issue.

For the information of *Journal* readers who are interested, the principal additions and amendments are here recorded with brief explanatory comment. The changes are dealt with in numerical order—that is, according to the number of the original rule in which they happen to occur.

In Rule No. 1, under the heading "Change of Ownership during Testing Period," and as a separate clause (*c*), the following provision has been made:—

> The acceptance of an application for the entry of a cow will not bind the Department to continue the supervision of the test in the event of change of ownership during the testing-period. The Department will, however, make every endeavour to continue the test, provided it is notified, within one week after the date of the sale, of the name and address of the purchaser, and provided also that such continuance shall be contingent upon the agreement of the new owner to comply with the rules herein contained.

The object and meaning of the various portions of this clause should be obvious. Firstly, when a cow is accepted for test the Dairy Division has no knowledge of the locality into which she may go in the event of sale, and thus can undertake to continue the test only so long as she remains at the farm on which she was originally entered. Secondly, the Division must be notified promptly of change of ownership, in order to allow time to arrange a visit to the new farm, and also to enable a proper check to be kept on milk-weights as recorded by the purchaser. Thirdly, when a person enters a cow for C.O.R. test he agrees to conform to the C.O.R. rules, but this does not concern the purchaser. In order, therefore, to safeguard the Department and the C.O.R. system it is necessary that the purchaser should signify his agreement to carry out the duties as prescribed for the owner.

In Rule No. 2 an identification safeguard has been provided. The clause which has been inserted reads :—

The owner shall, on request, supply for identification purposes a photograph of any cow entered for C.O.R. test.

Several new clauses, as follows, have been added to Rule No. 3 :—

(*d.*) . . . . In cases where it is found that the owner's milk scales are not reading correctly (either through the scales being inaccurate or through incorrect tare for the weighing-bucket being allowed), the Director of the Dairy Division shall have power to adjust the milk-weights by such amount and for such period as he deems proper.

(*h.*) No cow shall be milked more than three times daily.

(*j.*) The cow shall be milked the same number of times on the days of the Testing Officer's visit as she has been immediately prior to such visit.

(*k.*) The owner or his agent shall see that the milk submitted to the Testing Officer for sampling or weighing, or both, is the milk as it came from the cow, and that nothing has been added or taken away.

(*l.*) The owner shall see that the conditions pertaining to the treatment, milking, &c., of cows on C.O.R. test at the time of the Testing Officer's visit shall meet with the approval of the Testing Officer.

(*m.*) Where the Director of the Dairy Division may consider it necessary the owner shall provide the Testing Officer with free board and lodging during the period of his testing visit.

The meaning of and the need for these additions will be fairly apparent, but a few comments may be added. In regard to clause (*j*) it is evident that the Testing Officer's check on milk-yield would be practically worthless were the breeder permitted to increase or decrease the number of milkings per day for the days the Testing Officer was present for the purpose of carrying out his checking and sampling. With reference to clause (*m*) it may be stated that in the case of some breeders whose farms are in outlying districts there is often no boarding-house or hotel within convenient distance of the testing breeder's farm. In some of these cases the travelling-expenses of the Testing Officer are extremely high, so that, where it may be deemed necessary, it is expected that the breeder who desires his cows tested under the C.O.R. system will assist the Division to carry out the work on his behalf by providing the Testing Officer with free board and lodging during the time it is necessary for him to be at the farm.

To Rule No. 8, "Qualifications relating to Dates of Calving—Premature Calving," the following proviso has been added :—

Provided also that, wherever he may consider it necessary, the Director of the Dairy Division may require the owner to supply a veterinarian's certificate regarding calving subsequent to test.

This, as it will be surmised, is to provide for a greater security in cases where there is insufficient evidence as to the calving or date of calving subsequent to test of any cow which has otherwise qualified for her certificate.

Under Rule No. 9, which treats with the rights and duties of the Testing Officer, the following provision has been added :—

The Testing Officer shall keep the cow and the milker under strict supervision during the whole of the milking operation.

This simply means, of course, that any breeder failing to give the Testing Officer every facility to carry out this branch of his duties will be considered to have made a breach of the C.O.R. rules.

To Rule No. 11 the following clause has been added :—

If the owner of a cow under test or any agent of the owner commits any breach of these rules so as to warrant the discontinuance of the test, the Director may, if he considers the breach of sufficient gravity, discontinue the testing of all or any other cows belonging to the same owner and under test. No refund of fees shall be made in any such case.

There have been some instances of debate among breeders as to who is entitled to the certificate in the case of sale of a C.O.R. test cow. To cover this point a clause, which reads as follows, has been added to Rule No. 14 :—

Every certificate shall appertain to the cow to which it relates, and shall be given to the owner of the cow at the date of her calving subsequent to test. If the owner at that date is not the person who entered the cow for testing, the latter may obtain a copy of her certificate on application in that behalf.

It is considered that this should meet the case quite reasonably and fairly.

Rule No. 17, "Non-issue or Cancellation of Certificate — Issue of Certificate," has been altered and added to so that it now reads as follows :—

(*a.*) No certificate, either first or second class, shall be granted if in the opinion of the Director of the Dairy Division the milk-weights as forwarded by the owner have not been authenticated, or if the owner commits any breach of these rules : Provided that in cases where the Director of the Dairy Division considers the main objective of the C.O.R. testing will be better met he may issue a certificate based on the recorded milk-weights adjusted to such extent as he deems right and proper.

(*b.*) A certificate may be cancelled and the record expunged if it subsequently be found that in the opinion of the Director of the Dairy Division, and of the majority of the executive of the breeders' association of which the owner is, or was, a member, the record was not made in accordance with the rules. In any case of the non-issue of a certificate the decision of the Director shall be final, and need not be accompanied by any statement of the reason governing the decision.

(*c.*) In every case where a cow qualifies for a certificate of record such certificate may be issued and particulars entered in the records of the Department, and forwarded to the secretary of the breeders' association concerned.

In the "Reminders," at the close of the rules, a section referring to declarations has been inserted as follows :—

The attention of owners is drawn to Rule No. 7. The prompt return of declarations not only ensures the issue of certificates, but facilitates the compilation of records, summaries, &c., at the Dairy Division's headquarters.

There is always a small proportion of C.O.R. breeders who neglect to attend promptly to the completing and returning of declarations pertaining to the records of their cows which have completed test. This causes a good deal of inconvenience in connection with the preparation of summaries and returns in the Dairy Division's head office ; further, as no certificate can be issued until such time as the declaration is properly completed and received back, much delay is caused at the end of the calendar year when the annual summary of C.O.R. results is being compiled. Almost annually the summaries are not wholly complete because of a few outstanding declarations. During the last two or three years the matter has become so serious that the Division may have to consider enforcing that portion of Rule No. 7 which provides that if the declaration is not returned within thirty days of date of despatch acceptance of further applications may be refused.

EXPERIMENTS ON MANURING OF POTATOES IN CANTERBURY, SEASON 1924-25.

(Concluded.)

F. E. WARD, Instructor in Agriculture, and A. W. HUDSON, B.Sc., B.Ag., Assistant Instructor in Agriculture, Christchurch.

EXPERIMENT 2: ON FARM OF W. AND A. CAMPION, PREBBLETON.

IN this experiment sowing was done on 17th November, 1924; weighings were made on 27th and 28th July, 1925.

The recent previous history of the field was three years of grass, followed by a winter fallow prior to sowing of potatoes.

As with Experiment 1 (see last month's *Journal*), all plots were sown in quadruplicate, but only one control was included in each series. The insoluble phosphate in this case was Ephos basic phosphate, containing about 62 per cent. tricalcic phosphate. The nitrogen was applied in the form of dried blood.

The series were comprised of the following manurial treatments, applied in the order shown, the manures being sown with the seed throughout :—

	Quantity per Acre.
(1.) Superphosphate, 42/44 grade	.. 3 cwt.
(2.) Super, 1½ cwt.; plus Ephos, 1½ cwt. ..	.. 3 cwt.
(3.) No. 2 mixture; plus sulphate of potash, ¾ cwt.	.. 3¾ cwt.
(4.) No. 2 mixture; plus dried blood, 1 cwt.	.. 4 cwt.
(5.) No. 3 mixture; plus dried blood, 1 cwt.	.. 4¾ cwt.
(6.) Control.	

Only three rows—all of which were dug and weighed—were allocated to each plot. The average width between the rows was 25 in.

DETERMINATION OF YIELDS.

Digging was done by hand, and sorting carried out with a machine. Areas of ½ chain by three rows, each $\frac{1}{211}$ acre, were weighed in the same way as in Experiment 1, and comparisons made between plots adjacent to one another, except in the case of super plus Ephos *versus* super plus Ephos plus blood. In this case the compared plots were separated by an intervening one.

OBSERVATIONS DURING GROWTH.

One month after sowing the crop was well through the ground, and at this stage the controls were slightly inferior.

On 20th January, nine weeks after sowing, the controls were deciderly poorer in growth than the manured plots, and super, super plus Ephos plus blood, and the complete mixture were a little better than the super plus Ephos and super plus Ephos plus potash mixtures.

As shown in Table 3, the yields of table potatoes were extremely poor throughout. This is attributed to the fact that the ground on which the experiment was conducted had become set rather hard with rain.

It had been intended to plough the seed potatoes in, but owing to the manure-box being unsuitable the planter had to be resorted to, and, instead of a ploughing at planting, the ground was merely ridged. The adjoining part of the paddock, where the seed was ploughed in, gave a much better result. An excellent illustration of the necessity for adequate cultivation of the land was thus provided.

Table 3.—Comparison of Yields in Experiment 2.

Comparison, A *versus* B.	Number of Paired Plots.	Grade.	Yield in Tons per Acre. A.	B.	Difference in Favour of A.	Difference in Favour of B.	Odds.
A. Super	22	**Total**	9·31	6·69	2·62	..	> 24,000
B. Control	22	Table	1·89	1·26	0·63	..	> 24,000
		Seed	4·09	2·80	1·29	..	> 24,000
		Small	3·33	2·69	0·64*	..	..
A. Super plus Ephos ..	30	**Total**	8·22	9·25	..	1·03	> 24,000
		Table	1·40	1·92	..	0·52	> 24,000
B. Super	30	Seed	3·45	3·97	..	0·52	> 24,000
		Small	3·37	3·36	0·01*	..	..
A. Super plus Ephos ..	32	**Total**	8·14	8·45	..	0·34	2,173
		Table	1·39	1·78	..	0·34	> 24,000
B. Super plus Ephos plus sulphate of potash	32	Seed	3·42	3·56	..	0·14	11
		Small	3·33	3·11	0·22*	..	..
A. Super plus Ephos ..	32	**Total**	8·14	8·63	..	0·49	1,000
		Table	1·39	1·59	..	0·20	30
B. Super plus Ephos plus dried blood	32	Seed	3·42	3·66	..	0·24	90
		Small	3·33	3·38	..	0·05*	..
A. Super plus Ephos plus blood	32	**Total**	8·63	8·78	..	0·15	4
		Table	1·59	1·95	..	0·36	> 24,000
B. Super plus Ephos plus blood plus sulphate of potash	32	Seed	3·66	3·79	..	0·13	7
		Small	3·38	3·04	0·34*	..	..

* Not treated statistically.

COMMENTS ON TABLE 3.

Super *versus* control: In this comparison the increase in marketable potatoes (table and seed), valued as in Experiment 1, is worth £3 16s. 6d. The cost of 3 cwt. of super is £1 1s. 9d., so that even in such a poor crop the manure effects a profit of £2 14s. 9d. per acre. There is a decrease of 3·5 per cent. in the percentage of small potatoes due to super.

Super plus Ephos *versus* super: The superiority of super over the mixture of super and Ephos needs no further comment, especially as the costs of each are almost identical. The super shows a 4-per-cent. greater proportion of table potatoes than the mixed phosphates.

Super plus Ephos *versus* super plus Ephos plus potash: The increase in yield of table potatoes brought about by the addition of potash is sufficient to leave a profit of about 6s. per acre—certainly not enough in this case to justify its inclusion, but causing no monetary loss. The potash has caused an increase of 3·5 per cent. in the tables, with a corresponding decrease in small potatoes.

Super plus Ephos *versus* super plus Ephos plus dried blood: The value of the increase of table and seed potatoes due to the blood is about 19s. 6d., against which must be reckoned the cost of 1 cwt. of blood, 13s. Again there is only a slight profit, of 6s. 6d. The blood has caused no significant difference in the percentage of the various grades.

Super plus Ephos plus blood *versus* super plus Ephos plus blood plus potash: The addition of potash to the otherwise complete mixture again shows an increase of about ⅓ ton of table potatoes (although the total yield is not significantly affected), and a consequent profit of about 6s. per acre. The increase in the percentage of tables is of approximately the same order as when the potash was added to the phosphate mixture. It is problematical whether the potash and blood would have shown a more handsome profit had the crop been an average one, but it seems likely that such would have been the case.

The writers are indebted to Messrs. L. C. Banks and W. Campion for their whole-hearted interest and assistance in carrying out the work, which, with certain modifications, is being repeated on the same farms in the current season.

DRY-PICKLING OF SEED WHEAT WITH COPPER CARBONATE.

Following on work carried out at the Ashburton Experimental Farm by Mr. J. C. Neill, Field Mycologist, the Department of Agriculture recently imported two machines (from Australia and America respectively) for the pickling of seed wheat with copper-carbonate dust. These machines were sent to various districts in Canterbury and North Otago, and a proportion of the farmers' seed-supply has been treated.

This season Lincoln Agricultural College sold a large quantity of seed wheat, and arrangements were made with the College for the treating of one-quarter of the supply with copper carbonate. When a farmer ordered wheat from the College, one-quarter of his order was filled with treated seed, and this would be sown alongside the remaining three-quarters, which had been wet-pickled by him

The advantages of dry-pickling briefly are,—

(1.) Ease and economy of mixing with the seed. Copper-carbonate dust is mixed dry with the seed at the rate of 2 oz. to the bushel (60 lb.) of seed.

(2.) Saving of time. The material can be mixed with the seed during spare time, whenever convenient, and stored until the time of planting.

(3.) Uniform seeding. Seed treated with copper carbonate will not attract moisture or become sticky, therefore will run cleanly through the drills or seeders.

(4.) Less injury to seed, and less retarding of growth. This may result in larger yields due to the increased germination.

The cost of pickling, with copper carbonate at 1s. 3d. per pound, is approximately 2d. per bushel, but this cost would be more than compensated by increased germination of the seed.

—*F. E. Ward, Instructor in Agriculture, Christchurch.*

BUTTER-BOX TESTS.

DEVELOPMENT OF BALANCED CONSTRUCTION TO MINIMIZE BREAKAGE DURING TRANSIT.

W. C. WARD, Forest Products Branch, New Zealand State Forest Service.

INTRODUCTION.

THIS article presents the results of a series of tests made by the Forest Service, at the request of the Dairy Division of the Department of Agriculture, with the object of improving the serviceability of the butter-boxes now used in the export trade. It should be read in sequence to the article, "Butter-boxes and their Design," published in this *Journal* for September, 1924.

The laboratory studies here described combine practical experience—which is a knowledge of the designs in use, of what timber is available, and of box-factory practice—with accurate scientific tests made on the package itself, packed as in actual service and subjected to strains that approximate actual transportation conditions.

The main purpose of the study was to develop a balanced and economical construction—that is, a box which has enough strength in each part for the purpose for which it is intended, and no more strength in any part than is necessary to balance the average strength in every other part. The essential qualifications for an export butter package are (1) that it be strong enough to stand up under exceptional rough handling; (2) that it be able to resist punctures from the corners or edges of other containers; (3) that it occupy the minimum of space; and (4) that it be difficult to open and reclose without special tools—a preventive of concealed pilfering. It was necessary to secure these four qualifications without a burdensome cost.

Although the immediate purpose was to formulate a specification for a standard box for the export trade, the scope of the work was extended to include a study of the various types of containers now in common use, and to provide data for the general instruction of box manufacturers and users regarding certain fundamentals of box design. The study may be still further extended at a later date to investigate other types of butter-containers which appear to promise improvement upon existing practices.

BOXES TESTED.

In developing the new specification the Forest Service considered that the approximate shape of the existing box, which is well known on the butter-markets of the world, should be preserved. In accordance with this principle the inside length of all boxes tested was kept constant at $15\frac{1}{8}$ in., and the cross-sectional dimensions varied to make side and top and bottom boards of equal width, while still keeping the cubical capacity constant.

With the exception of the Saranac box all boxes tested were of the type known as style 1 in the box trade. In this type of box the grain of the ends and sides runs approximately parallel to the top and

bottom surfaces, while the ends are uncleated. Five boxes were tested to study each variable. The results in most cases were consistent enough to give a reliable average based on the tests of only three boxes, and the results for the strapped boxes are based on this number of tests.

The recommendations of the Madison Forest Products Laboratory of the United States Forest Service were followed in the nailing and strapping of boxes. Only 5D and 7D cement-coated nails* were procurable from local stock, and therefore used where 6D would have proved more suitable.

and No. 13½ gauge Gerrard wire, were used on boxes bound with nailless bindings.

Acme flat-steel strapping, ½ in. × 0·018 in. and ⅜ in. × 0·015 in.,

The Saranac box is similar to that shown in Figs. 1 and 2. Fig. 1 shows a "mat" for what is known as a "four-one" box, delivered by a stitching or fabricating machine, ready to be assembled with the end panels, or shipped in this form to the consumer. The cleats are held to the sheet material forming the sides, top, and bottom by staples which pass over the wires, through the sheet material, and have their points firmly held in the cleats. Staples not driven into cleats are clinched in the inside surface of the sheet material. The box is assembled by folding the mat around the two end pieces, which are stapled or nailed on the inside surface of six of the cleats, the remaining cleat on each end being attached to the top only, as shown in Fig. 2. To close the box the binding-wires are twisted together near one edge of a side. The end joints of the cleats may be mortise-and-tenon, step, or plain mitre type.

There are a number of similar boxes on the market, the chief variation being in the method of attaching the ends. The Saranac, for example, attaches only two cleats at each end of the mat, the remaining cleats being stapled to the ends. In assembling the box the sides are stapled to the two cleats attached to the ends. This has the advantage of requiring only an outside stapling-machine, compared with an inside stapler required for the four-one type.

Wire-bound boxes are opened for grading and inspectional purposes by cutting the wires at their original fastenings. They are closed by twisting on a new piece of wire to one of the loose ends and twisting the two wires together again.

TESTS TO DETERMINE BOX DESIGN.

The most practical method yet devised for testing packing-boxes is the revolving-drum test. For this purpose a replica of the machine shown in Fig. 3 was installed by the Forest Service at its timber-testing station maintained at the School of Engineering, Canterbury University College, Christchurch. The drum is a hexagon-sided machine, and revolves slowly at a rate of 1⅝ revolutions per minute.

* The size of cement-coated nails is expressed in pennies and designated throughout this article by the letter "D." The dimensions are as follows: 4 penny (4D), 1½ in. long, 14 A.W. gauge; 5 penny (5D), 1⅝ in. long, 13½ A.W. gauge; 6 penny (6D), 1⅞ in. long, 13 A.W. gauge; 7 penny (7D), 2⅛ in. long, 12½ A.W. gauge. Cement-coated nails are designated by the letters "c.c."

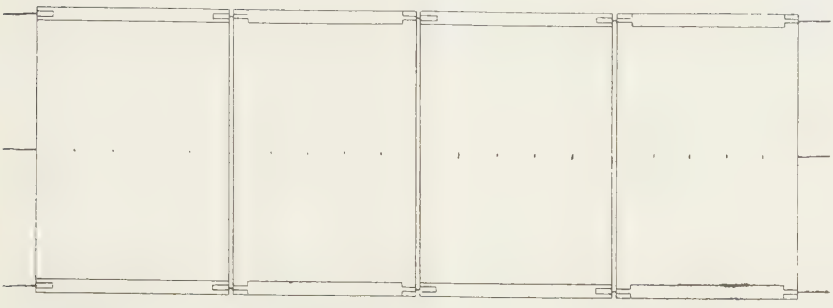

FIG. 1. MAT OF THE FOUR-ONE WIRE-BOUND VENEER BOX.

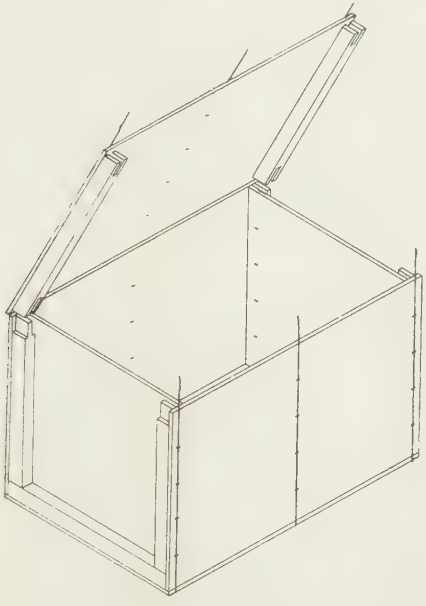

FIG. 2. THE FOUR-ONE BOX ASSEMBLED.

The box to be tested is packed with 56 lb. butter, as in commercial service, and placed in this drum. In the drum is arranged a series of hazards, which cause the box to follow a regular cycle of drops, falling upon sides, top, bottom, ends, edges, corners, and flatwise upon a projection similar to the corner of another box. These drops simulate the usual hazards of transportation. Each face of the drum is counted as one drop.

To facilitate the recording of the locations and character of the failures the faces and edges of the box are numbered as shown in Fig. 4. As the box moves on from one drop to the next the observer notes the beginning of the failure of the weakest point in the construction, and

follows its development and that of other weaknesses until the box entirely fails and lets its contents out. The weak feature of the box may be too few or too short nails, or too thin sides or ends. Such weaknesses are studied until the observer is able to build up a box having equal strength in every feature and capable of delivering its contents in the same condition as when first shipped.

The mechanical tests of the bindings and fastenings were made at the Forest Service timber-testing station maintained at the School of Engineering, Auckland University College.

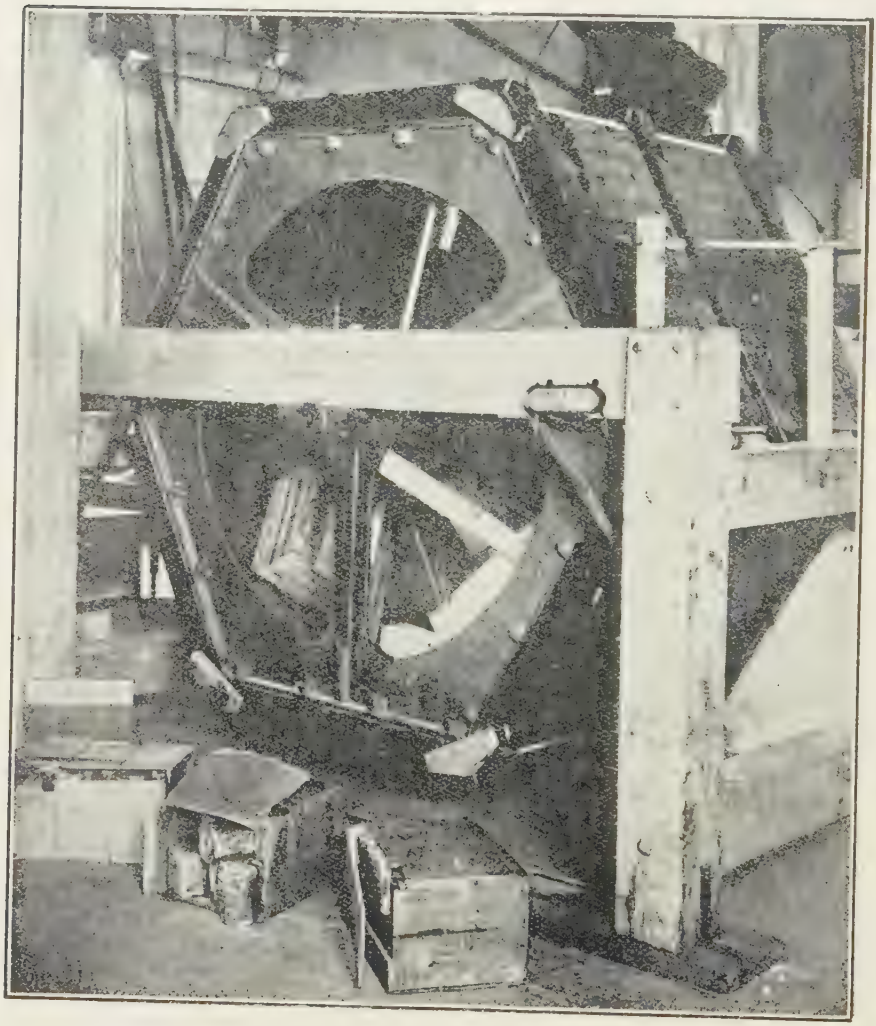

FIG. 3. REVOLVING-DRUM BOX-TESTING MACHINE.

A similar machine—installed at the Forest Service Testing Station, School of Engineering, Canterbury University College—was used for the tests here recorded.

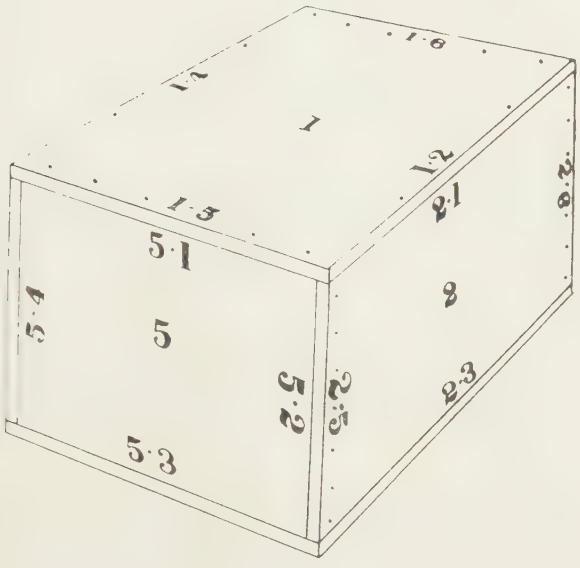

FIG. 4.—STANDARD MARKING FOR BOX-TESTS.

Showing method used to assist in recording results of tests and studying weaknesses of construction.

ANALYSIS OF RESULTS.

The results of the tests are shown graphically on a series of charts. A detailed description of the boxes tested immediately follows each chart, which is generally confined to the study of a single variable in design. The length of lines on the chart represents the relative number of drops to cause loss of contents.

For convenience of comparison in making this analysis the white-pine box to the following specification is taken as 100 per cent. for comparing the other designs :—

Inside dimension—15⅛ in. long by 11¼ in. deep by 10¼ in. broad.
Sides, top, and bottom—one piece, ½ in. thick.
Ends—one piece, ⅝ in. thick.
Nails—Into ends, 5/7D c.c. per nailing-edge.
Space into sides, 2/7D c.c. per nailing-edge.

Chart 1 represents the results obtained from two groups of boxes nailed with ordinary and with cement-coated nails. The failure of the boxes fastened with ordinary nails was in all cases due to pulling of the nails from the end of the box, a weakness which was entirely eliminated by the substitution of cement-coated nails. The chart shows that the serviceability of the box is so improved by the use of cement-coated nails that their general use is recommended to shippers for both export and domestic packages.

Kind of Nails.	Number of Drops required to spill Contents.		Relative Strength to Box with c.c. Nails.
	Graphical Representation.	Number.	
Smooth wire		25	0·13
Cement-coated		190	1·00

CHART 1. EFFECT OF SUBSTITUTING CEMENT-COATED NAILS FOR SMOOTH-WIRE NAILS.

Details of Boxes tested. — Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 11¼ in. deep by 10¼ in. broad. Sides, top, and bottom: One piece, ½ in. thick. Ends: One piece, ⅝ in. thick. Nails: Into ends, 5/7D per nailing-edge; space into sides, 2/7D per nailing-edge.

Cement-coated nails are used almost universally by box-manufacturers in Canada and the United States, as they have a much higher resistance to withdrawal than plain uncoated nails. The cement coating of the nail consists of various resinous gums mixed by a secret formula, and put on the nails by a baking process. Though the makers do not claim that the nails are absolutely rust-proof, they do claim that nails thus treated will resist the effects of moisture from 20 to 50 per cent. better than the uncoated wire nail. But it is when in use that the non-rusting quality is most evident. There is more coating on the nails than is actually necessary for holding-power. The heat caused by the friction in driving the nail softens the coating, and the surplus is forced towards the head, completely closing any opening: this prevents the admission of moisture between the wood and the nail. Under similar conditions of use the life of a cement-coated nail will be about twice as long as that of an uncoated one. They are claimed to require less force to drive, as the softened coating forms a lubricant. Any slight difficulties attached to their handling in the box-factory do not outweigh the advantages gained, and it is very desirable that the cement-coated nail should be adopted for boxing-work throughout New Zealand. Whereas a 2 in. cement-coated nail driven 1⅝ in. into the side grain of a piece of American pine required a force of 226 lb. to withdraw it, a common nail under the same conditions was withdrawn with a force of only 106 lb.

Chart 2 shows the relative resistance to loss of contents between the three kinds of boxes in common use in New Zealand. The results are borne out by practical experience. The white-pine box resisted loss of contents more than four times better, and the beech box more than eight times better, than the spruce box. The poor nail-holding quality of the spruce wood and its tendency to split easily are features which do not produce a box of first-class carrying-qualities. Typical splitting of side and end boards is illustrated in Fig. 7.

Species of Timber.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to White-pine Box.
White-pine		190	1·0
Silver-beech		364	1·92
Spruce		44	0·23

CHART 2. EFFECT OF VARYING SPECIES OF TIMBER USED.

Details of Boxes tested.—Inside dimensions: 15⅛ in. long by 11¼ in. deep by 10¼ in. broad. Sides, top, and bottom: One piece, ½ in. thick. Ends: One piece, ⅜ in. thick. Nails: Into ends, 5/7D c.c. per nailing-edge; space into sides, 2/7D c.c. per nailing-edge.

Tests were made with four groups of boxes nailed with five, six, seven, and eight cement-coated nails per nailing-edge. Chart 3 represents the results obtained from these tests. The enormous increase in strength obtained by a small increase in the number of nails is clearly apparent. Most failures commenced by splitting of the sides, followed by splitting of the ends, thus allowing the boxes to break in two, as shown in Fig. 5, which is a photograph of an eight-nailed box.

Number of Nails per Edge.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to Five-nail Box.
5		190	1·0
6		248	1·3
7		580	1·1
8		1,165	6·1

CHART 3. EFFECT OF VARYING THE NUMBER OF NAILS ATTACHING SIDES, TOP, AND BOTTOM TO ENDS.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 11¼ in. deep by 10¼ in. broad. Sides, top, and bottom: One piece, ½ in. thick. Ends: One piece, ⅜ in. thick. Nails: Into ends, 7D c.c.; space into sides, 2/7D c.c.

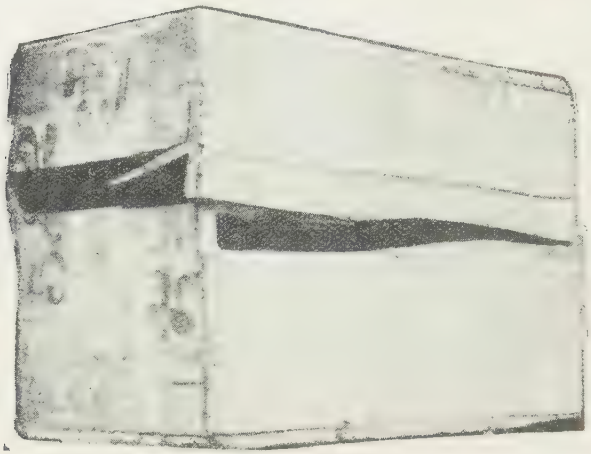

FIG. 5. TYPICAL FAILURE OF UNSTRAPPED BOX (EIGHT NAILS PER NAILING-EDGE).
Split commenced in sides and extended to ends, allowing box to break in two.

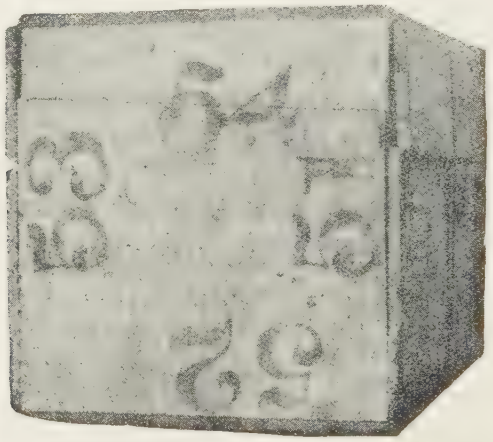

FIG 6. TYPICAL FAILURE OF STRAPPED BOX.
Nature of failure similar to that of unstrapped box in Fig. 5, splitting commencing in sides and extending to ends. Strap still holds two loose halves of box together.

Chart 4 represents the results obtained from the tests of two groups of boxes having one-piece and two-piece sides. The two pieces constituting a side differed considerably in width, and in assembling boxes the joints of the two-piece sides were staggered, so that there was a considerable distance between their respective planes.

Number of Pieces in Sides.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to One-piece-sided Box.
1-piece		190	1·00
2-piece		73	0·38

CHART 4. EFFECT OF VARYING NUMBER OF PIECES IN SIDES.

Details of Boxes tested. — Timber: N.Z. white-pine. Inside dimensions: 15⅝ in. long by 11¼ in. deep by 10¼ in. broad. Sides: ½ in. thick. Top and bottom: One piece, ½ in. thick. Ends: One piece, ⅝ in. thick. Nails: Into ends, 5/7D c.c. per nailing-edge; space into sides, 2/7D c.c. per nailing-edge.

The advantage of single-piece sides is pronounced. They act to reinforce the ends against splitting. The boxes with two-piece sides invariably commenced to fail by splitting of the ends, the split occurring along the nails holding the narrower pieces of the sides.

Chart 5 represents the influence of flat strapping of unannealed metal applied parallel to the ends, and in two directions (one parallel to the ends and the other perpendicular to the grain of the ends). Tests were made on boxes with two thicknesses of sides, top, and bottom—⅜ in. and $\frac{5}{16}$ in.

As has been stated, the box without strapping invariably failed by the sides and ends splitting and allowing the box to break in two. When one strap was applied around the centre of the box parallel to the ends the failures occurred in the same way as before, but only after a much rougher handling than the unstrapped box received. A typical failure is shown in Fig. 6. The two parts of the box were held together by the strap, but the test was discontinued immediately the block of butter became damaged by shearing of these loose parts or by the sides pulling off.

Two flat straps applied 3 in. from each end of the box did not change the nature of the failure, and only slightly better results were obtained. One flat strap applied round the centre parallel to the ends, and another lengthwise of the box perpendicular to the grain in the ends, gave still better results than the two parallel straps, but ultimate failure occurred by the lengthwise strap breaking after the ends had split.

In all cases the boxes with ⅜ in. sides, top, and bottom resisted breakage 50 per cent. better than those of $\frac{5}{16}$ in. material.

A similar series of tests comparing boxes bound with flat straps and round wires of unannealed metal indicates that a hard wire of approximately the same mechanical properties as the flat strapping tested, and with a fastener of equal efficiency, would give results equal to those represented in Chart 5.

Thickness of Sides.	Number and Size of Nails.	Number, Width, and Point of Application of Strapping.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to unstrapped Box.
½ in.	5 7D	..		190	1·0
⅝ in.	5 7D	1—½ in., central		342	1·8
⅜ in.	5 7D	2—⅜ in., parallel		372	2·0
⅜ in.	5 7D	2—⅜ in., crossed		418	2·2
5/16 in.	7 5D	1—½ in., central		230	1·2
5/16 in.	7 5D	2—⅜ in., parallel		267	1·4

CHART 5. EFFECT OF APPLYING FLAT METAL STRAPPING AND DECREASING THICKNESS OF SIDES.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 10⅞ in. deep by 10⅜ in. broad. Sides, top, and bottom: One piece. Ends: One piece, ⅝ in. thick. Nails: c.c. Strapping: Maximum tensile strength, 97,500 lb. per sq. in.; efficiency of fastening, 75·2 per cent.; thickness, ½ in. wide by 0·018 in. thick; ⅜ in. wide by 0·015 in. thick.

Thickness of Sides.	Number and Size of Nails.	Number and Point of Application of Wire Binding.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to unstrapped Box.
½ in.	5/7D	..		190	1·0
⅜ in.	5/7D	1—central		154	0·81
⅜ in.	5/7D	2—parallel		216	1·14
5/16 in.	7/5D	1—central		124	0·65
5/16 in.	7/5D	2—parallel		192	1·01

CHART 6. EFFECT OF APPLYING ROUND WIRE BINDING AND DECREASING THICKNESS OF SIDES.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15⅛ in. long by 10⅞ in. deep by 10⅜ in. broad. Sides, top, and bottom: One piece. Ends: One piece, ⅝ in. thick. Nails: c.c. Wire binding: Maximum tensile strength, 90,000 lb. per sq. in.; efficiency of fastening, 86·2 per cent.; gauge, No. 13½ B.W. gauge.

Type of Box.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to Unstrapped Box.
Unstrapped		190	1·00
Saranane		31	0·16

CHART 7. TEST OF SARANAC WIRE-BOUND BOX WITH PRESENT STANDARD UNSTRAPPED BOX.

Details of Boxes tested.—Timber: N.Z. white-pine. Inside dimensions: 15¼ in. long by 11 in. deep by 10¼ in. wide. Sides, top, and bottom: Two piece, ¼ in. thick. Ends: One piece, ¼ in. thick. Cleats: 13/16 in. wide, ¾ in. thick. Staples: Spaced 2 in. apart. Binding: 14½ B.W. gauge.

Species of Timber.	Thickness of Sides.	Number of Straps and Point of Application.	Number of Drops required to spill Contents. — Graphical Representation.	Number.	Relative Strength to unstrapped White-pine Box.
White-pine	½ in.	..		190	1·00
White-pine	⅜ in.	1 central		342	1·80
Spruce	½ in.	1—central		203	1·07

CHART 8. COMPARISON BETWEEN NEW ZEALAND WHITE-PINE AND IMPORTED SPRUCE BOXES.

Details of Boxes tested.—Inside dimensions: ½ in. sides—15⅛ in. long by 11¼ in. deep by 10¼ in. broad; ⅜ in. sides—15⅛ in. long by 10⅞ in. deep by 10⅝ in. broad. Sides, top, and bottom: One piece. Ends: One piece, ⅜ in. thick. Nails: Into ends, 5 7D c.c. per nailing-edge; space into sides (½ in.), 2/7D c.c. per nailing-edge. Strapping: Flat, hard metal, ½ in. wide by 0·018 in. thick.

The influence of wire binding of annealed metal applied similarly to the flat strapping is represented by Chart 6. Tests were made on boxes with two thicknesses of sides, top, and bottom, $\frac{3}{8}$ in. and $\frac{5}{16}$ in. While some increased serviceability might be obtained by increasing the size of the wire to 13 B.W.G., as recommended by the wire-binding manufacturers, the tendency of the annealed metal to stretch quite early in the test reduces its efficiency as a binding. Fig. 7 illustrates the stretching of these bindings. The results are similar to those secured in other series of tests. The increased serviceability of the box with $\frac{3}{8}$ in. sides, top, and bottom over that with $\frac{5}{16}$ in. material was not as great as with flat strapping of unannealed metal.

Chart 7 shows the comparison between the present standard unstrapped box (with $\frac{1}{2}$ in. sides, top, and bottom, and $\frac{5}{8}$ in. end, but nailed with 5/7D c.c. nails per edge) and the Saranac wire-bound box.

The tests show that the Saranac boxes submitted for test were unsuitable for export shipment. They had less than one-sixth the resistance to loss of contents of the $\frac{1}{2}$ in. unstrapped boxes, failure occurring by puncturing of the thin sides. The wood appeared to be brittle, probably arising out of the drying of the wood at too high a temperature. Even with this fault remedied, however, the $\frac{1}{4}$ in. sides would be too thin.

Chart 8 shows that the imported spruce box reinforced with one $\frac{1}{2}$ in. central flat strap is little superior to the unstrapped white-pine box, and markedly inferior to the $\frac{3}{8}$ in. side white-pine box reinforced with one $\frac{1}{2}$ in. central flat strap.

CONCLUSIONS.

The results of the foregoing studies may be summarized as follows :—

(1.) The use of cement-coated nails is essential if an economical and balanced package is to be designed.

(2.) Adequate nailing is of the utmost importance in box-construction.

(3.) Silver-beech ranks first, white-pine second, and spruce last in suitability for butter-boxes when carrying-qualities are considered.

(4.) The one-piece-side box is markedly superior to the two-piece-side box.

(5.) Flat strapping or wire binding of unannealed metal is of great value as a reinforcement on all boxes.

(6.) Resistance to loss of contents increases with the number of straps used. Two straps applied in two directions gave better results than two straps applied parallel.

(7.) Decreasing the thickness of sides, top, and bottom of white-pine boxes below $\frac{3}{8}$ in. results in marked reduction in strength.

(8.) Wire bindings of annealed metal increase the resistance of a box to loss of contents, but are inferior to flat strap or wire binding of unannealed metal.

(9.) Sides less than $\frac{5}{16}$ in. in thickness puncture easily. The drying of thin boards by artificial heat should be carefully controlled to prevent brittleness.

FIG. 7. SHOWING STRETCHING OF WIRE BINDINGS OF ANNEALED METAL.
Such bindings stretch easily and lose their efficiency as a box-reinforcement.

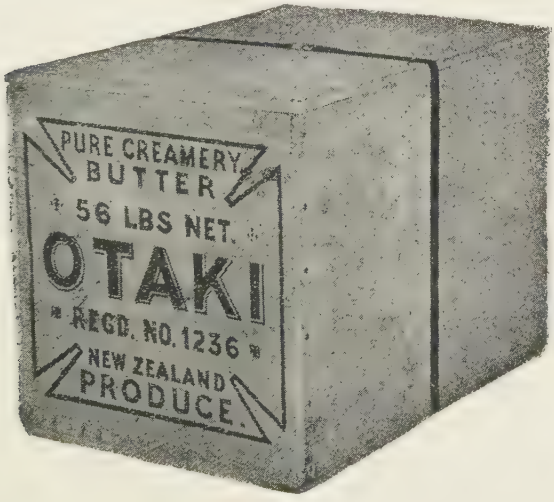

FIG. 8. THE PROPOSED STANDARD STRAPPED BOX.

Fourteen times stronger than the present unstrapped box; occupies 3 per cent. less space; is from ½d. to 1½d. cheaper—depending on the sawmiller's prices.

RECOMMENDATION FOR STANDARD BOX.

Having consideration to the various factors involved the Forest Service recommends the use of *one standard box for the export trade.* This package is similar to that shown in Fig. 8.

It consists essentially of one-piece ends, $\frac{5}{8}$ in. thick if white-pine, or $\frac{1}{2}$ in. thick if silver-beech; one-piece sides, top, and bottom, $\frac{3}{8}$ in. thick if white-pine, $\frac{5}{16}$ in. thick if silver-beech; six cement-coated nails per nailing-edge, 6D ($1\frac{5}{8}$ in.) for white-pine, 4D ($1\frac{3}{8}$ in.) for beech; and one centrally located galvanized strap of hard (unannealed) metal, $\frac{1}{2}$ in. wide by 0·018 in. thick. Spruce is not a suitable wood for this construction.

The box is approximately fourteen times stronger than the present standard unstrapped package, occupies 3 per cent. less space, is from 1d. to $1\frac{1}{2}$d. cheaper, and withal is a highly attractive package, which will maintain on the world's markets that individuality of get-up which until last season has always characterized New Zealand dairy-produce abroad.

A detailed specification for the package follows:—

SPECIFICATION FOR STANDARD METAL-BOUND BUTTER-BOX FOR EXPORT.

Section A: General.

(1.) Definition: The box as herein specified shall be known as the standard metal-bound butter-box—export type.

Section B: Timber.

(2.) Woods used: The following timbers shall be admitted under this specification: White-pine (*Podocarpus dacrydioides*) and silver-beech (*Nothofagus Menziesii*).

(3.) Material: (*a.*) The ends, sides, top, and bottom of the box shall be well manufactured, and shall be cut true to size. All defects in the timber which materially lessen the strength of the part, or expose contents to damage, or interfere with proper nailing, shall be prohibited. (*b.*) The wood shall be thoroughly seasoned, and shall have a moisture content not less than 10 per cent. nor more than 18 per cent., based on the weight of the wood after oven-drying to a constant weight.

(4.) Dimensions: (*a.*) The inside dimensions of the box shall be $15\frac{1}{8}$ in. long by $10\frac{7}{8}$ in. deep by $10\frac{5}{8}$ in. broad. The width of ends, sides, top, and bottom shall be $10\frac{7}{8}$ in. (The top and bottom do not cover completely the edges of the sides, which will be sprung inwards when the strapping is applied. This will assist to keep the strapping in tension.) (*b.*) The sides, top, and bottom shall be $\frac{3}{8}$ in. thick for white-pine boards, and $\frac{5}{16}$ in. thick for beech boards; the ends shall be $\frac{5}{8}$ in. thick for white-pine boards, and $\frac{1}{2}$ in. thick for beech boards. (*c.*) The variation in thickness of the boards below the thickness specified shall be not more than $\frac{1}{32}$ in., and this variation below the specified thickness shall not extend over more than 10 per cent. of the face of that particular board.

(5.) Width of parts: (*a.*) Ends, sides, top, and bottom shall be of single-piece material. (*b.*) Matched and glued or lock-jointed boards shall be regarded as single pieces.

(6.) Jointing: (*a.*) Matched and glued ends shall, in addition, be fastened with not less then two galvanized corrugated fasteners, 1 in. by $\frac{3}{8}$ in. (*b.*) All corners shall be chamfered.

(7.) Surfacing: (*a.*) The outside surfaces of the sides, top, and bottom may be fine band-saw or veneered finish; otherwise they shall be smooth-planed. (*b.*) The ends shall be veneered or smooth-planed.

(8.) Assembling: Joints in matched and glued sides shall be so located that there is a considerable distance between their respective planes.

Section C: Nailing.

(9.) Nailing schedule: (*a.*) $1\frac{5}{8}$ in. cement-coated nails (*i.e.*, nails coated with a resinous solution) shall be used when driving into white-pine ends, and $1\frac{3}{8}$ in.

cement-coated nails when driving into beech ends. (*b.*) Nails shall be driven flush. (*c.*) The sides, top, and bottom shall be attached to the ends by not less than six nails per edge.

Section D: Metal Binding.

(10.) Metal: (*a.*) Metal binding shall be of hard unannealed metal, and shall have a maximum tensile strength of approximately 84,000 lb. per square inch. (*b.*) The binding for export boxes shall be galvanized or otherwise treated to protect against rust.

(11.) Fastenings: The ends of bindings shall be fastened in such a manner that the joint shall have a breaking-strength of not less than 75 per cent. of the ultimate strength of the binding.

(12.) Size of binding: The metal binding shall be not less than $\frac{1}{2}$ in. in width by 0·018 in. in thickness, or wire of equivalent sectional area.

(13.) Application: (*a.*) Not less than one binding shall be used, placed centrally round the smallest dimension of the box at right angles to the side edges of the box. (*b.*) The binding shall be drawn sufficiently tight to sink well into the edges of the box and to spring the sides inwards.

SUMMARY.

The foregoing series of strength tests of various types of butter-boxes was made by the Forest Service to determine the accuracy of its recommended specifications discussed in the September, 1924, issue of this *Journal*.

The Forest Service has developed as a result of these tests an attractive metal-strapped box fourteen times stronger than the present unstrapped box, occupying 3 per cent. less room, and costing from $\frac{1}{2}$d. to $1\frac{1}{2}$d. less. A detailed specification for its manufacture is submitted.

The tests further indicate the superiority of cement-coated nails over smooth wire nails, and of the white-pine and beech boxes over the imported spruce packages, whether from North America or Scandinavia.

ACKNOWLEDGMENTS.

The following organizations have co-operated with the Forest Service in the work here described: Dairy Division, Department of Agriculture—general; School of Engineering, Canterbury University College—box tests; School of Engineering, Auckland University College—binding tests; Messrs. J. F. Hargreaves and Co. (Limited), Wellington, New Zealand agents for Acme strapping; Papanui Cool Stores (Limited), Christchurch—general; Johnson, Clapham, and Norris (Limited), Wellington, and United States Steel Products Company, New York—cement-coated nails.

Special acknowledgment is due to the Madison Forest Products Laboratory of the United States Forest Service for its many reports upon box design. These have enabled the present work to be carried to a conclusion without the laborious investigation of many features of design already studied by the American laboratory.

The planning, supervision, and presentation of the study have been under the charge of Mr. A. R. Entrican, Engineer in Forest Products, State Forest Service.

NOTE.—In addition to the article "Butter-boxes and their Design," the following matter dealing with the same subject generally has been published in this *Journal*: "Metal-bound Butter-boxes" (October, 1924); "Effect of Projecting Staples on Butter packed in Four-one Boxes" (July, 1925).

THE OFFICIAL SEED-TESTING STATION.

RECORD OF OPERATIONS FOR 1925.

N. R. Foy, Seed Analyst, Biological Laboratory, Wellington.

For the twelve months ended December, 1925, 8,146 seed-samples were tested at the Seed-testing Station. Of these samples, 1,242 were also analysed for purity. The total shows a decrease of 120 on the number tested for the previous year. Samples from farmers, included in the aggregate tested, numbered 203.

The movement of the testing-work throughout the year is shown in Table 1, and the number of samples of the various species tested is given in Table 2, both being compared with the preceding year. Including 1923 in the survey, there is in most cases a marked regularity over the last three years, the exceptions being an increase in dogstail and brown-top, and a decrease in white clover, cow-grass, cocksfoot, lucerne, and vegetable seeds.

Table 1.—Number of Samples received in the Different Months, 1925 and 1924.

Month.	Number.		Month.	Number.	
	1925.	1924.		1925.	1924.
January	553	556	July	537	469
February	700	748	August	852	699
March	878	866	September	895	1,014
April	659	853	October	740	556
May	592	938	November	683	506
June	674	650	December	403	411

Table 2.—Number of Samples received of the various Species, 1925 and 1924.

Species.	1925.	1924.	Species.	1925.	1924.
Lucerne	62	103	Paspalum	77	56
Alsike	75	74	Poa pratensis	60	51
White clover	237	293	Prairie-grass	25	19
Cow-grass and red clover	276	439	Other grasses	61	72
Crimson clover ..	35	25	Japanese millet ..	28	32
English trefoil	38	27	Oats	48	42
Lotus major	55	50	Other cereals	42	35
Other clovers	60	49	Mangolds	249	208
Perennial rye-grass ..	1,178	1,031	Turnips	449	417
Italian rye-grass ..	260	255	Swedes	290	133
Western Wolths rye-grass	194	176	Rape	184	86
Timothy	97	69	Kale	46	39
Crested dogstail ..	874	641	Chou moellier	38	34
Danthonia spp. ..	99	47	Carrots	89	82
Brown-top	124	54	Mustard	32	29
Chewings fescue ..	431	490	Forest-tree seeds ..	23	20
Meadow-fescue ..	37	33	Flower-seeds	14	24
Meadow-foxtail ..	49	49	Vegetables(other than peas)	250	410
Yorkshire fog	25	11	Peas (garden)	197	260
Cocksfoot	387	516	Tares, vetches, &c. ..	12	16

GRASSES.

Germination.—The average percentages of purity and germination of the main grass-seed are shown in Table 3. On the whole the average germination has been well maintained, with the exception of dogstail and Chewings fescue, where there is a decline, due in the case of dogstail to an increased percentage (23) of samples germinating in the seventies, and in Chewings fescue to the receipt of a large number of samples of interior seed in November and December (see Table 4).

To obtain an indication of the average growth of good-grade seed reference should be made to the figures in the various groups in Table 4. For example, timothy shows an average growth of 84 per cent., but this is low for good seed. The grouping shows that 69 per cent. of the seed grows over 90 per cent., and that the average of 84 has been pulled down by 15 per cent. of old samples growing under 50 per cent. First-grade timothy should therefore germinate over 90 per cent. Cocksfoot, on the other hand, shows a much wider range of growth; anywhere between 61 and 90 per cent. may be expected, depending upon the origin of the seed, whether Danish or Akaroa. Table 5 shows a difference of nearly 10 per cent. in the average growth of the two seeds, and that, while 40 per cent. of Danish germinates between 81 and 100 per cent., only 7 per cent. of Akaroa germinates in the same group. Therefore Danish should be expected to grow over or near 80 per cent. and Akaroa under 80 per cent.

The average growth of other grasses, &c., not included in the tables is as follows: Fiorin, 76 per cent.; Poa trivialis, 54 per cent.; ratstail, 30 per cent.; sheep's fescue, 40 per cent.; yarrow, 75 per cent.

Table 3.—Average Germination and Purity of the Main Grasses, 1925.

Species.	Percentage of Germination.			Percentage of Samples germinating between						Average Percentage of Impurities.	
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	Useful.	Weeds.
Perennial rye-grass	85	100	2	3	4	6	9	31	47	0·7	0·5
Italian rye-grass	87	100	32	2	2	5	9	29	53	0·5	0·2
Western Wolths rye-grass	88	100	7	2	1	3	9	32	53	0·2	0·2
Timothy ..	84	100	2	15	..	..	5	11	69	1·5	0·2
Crested dogstail	79	98	..	6	3	8	23	39	21	1·1	0·2
Cocksfoot ..	69	93	7	11	15	22	27	23	2	3·6	0·6
Brown-top* ..	67	98	20	16	14	29	15	19	7	0·7	1·1
Chewings fescue	73	100	0	22	5	9	15	25	24	1·1	0·5
Meadow-fescue ..	73	98	1	18	8	8	14	14	38	0·1	0·8
Poa pratensis ..	51	93	1	33	28	26	8	3	2	0·2	0·8
				0–20.	21–30.	31–40.	41–50.	51–60.	61–100.		
Meadow-foxtail..	21	43	2	36	43	8	6	7	..	5·7	3·1
Danthonia spp...	38	75	..	22	14	18	16	18	12	10·1	5·9
Paspalum ..	43	94	3	10	9	23	29	17	2	0·1	0·1

* Average content of chaff and inert matter in brown-top, 31 per cent.

Table 4.—Monthly Average Germination of the Main Agricultural Seeds.

Species.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Average for Year. 1925.	Average for Year. 1924.
White clover	90	89	92	88	93	91	88	90	91	88	89	87	89	88
Alsike	88	76	89	90	..	..	96	87	90	84	96	86	88	86
Cow-grass	92	89	90	90	80	84	91	86	91	84	90	88	88	91
Crimson clover	96	98	95	98	98	..	..	99	98	85	99	98	95	93
Lucerne	91	65	90	..	92	92	85	88	88	90	86	91	88	90
English trefoil	70	50	65	..	..	48	96	92	75	88	77	86	79	74
Lotus major	79	66	46	64	77	83	88	88	53	83	..	82	75	76
Perennial rye-grass	83	84	85	84	80	88	84	90	86	86	88	87	85	86
Italian rye-grass	86	85	87	89	94	89	85	88	89	91	80	91	87	87
Western Wolths rye-grass	89	84	88	91	84	83	92	87	85	95	86	89	88	90
Timothy	93	84	95	80	..	96	93	86	63	88	91	94	84	90
Brown-top	58	70	59	66	75	74	79	78	73	71	72	48	69	61
Red-top	..	82	..	..	..	..	80	95	..	93	..	77	83	75
Chewings fescue	78	82	63	91	86	73	73	68	65	83	46	45	73	80
Meadow-fescue	90	94	70	40	..	..	..	95	67	72	85	66	73	58
Meadow-foxtail	28	..	14	22	27	33	17	22	23	14	14	11	21	30
Danthonia	9	34	38	40	..	47	69	..	35	35	36	32	38	35
Poa pratensis	64	62	64	50	46	52	78	54	40	41	37	12	51	52
Prairie-grass	55	..	57	72	..	91	..	37	76	89	92	..	69	77
Crested dogstail	83	81	78	81	79	82	74	83	82	79	76	78	79	87
Cocksfoot	69	72	65	72	67	76	70	69	67	68	70	69	69	62
Paspalum	69	48	46	44	39	37	48	51	42	37	37	31	43	36
Oats	51	55	70	95	97	99	98	97	95	99	..	99	84	92
Peas	96	97	96	93	95	82	81	85	99	..	..	..	93	92
Turnip	85	87	89	89	90	91	90	82	92	88	84	91	87	90
Swede	76	74	73	85	86	86	86	84	87	85	86	83	84	86
Rape	90	98	94	75	91	88	88	85	90	92	88	91	89	89
Kale	67	90	..	98	88	91	60	80	94	84	82	78	86	80
Mangold*	119	134	126	135	128	83	81	72	70	77	68	79	74	..
Mustard	83	79	..	..	96	95	52	92	85	94	94	90	87	87
Carrot	61	49	71	62	72	57	74	72	57	65	..	67	69	66
Rye-grass—														
Southern	88	74	90	90	87	90	85	90	85	85	90	91	88	84
Canterbury	87	86	85	89	83	86	88	92	91	89	91	85	87	91
Sandon	81	64	67	62	60	66	27	56	68	82	55	84	67	82
Hawke's Bay	92	90	93	93	..	90	91	93	93	89	91	89	91	90
Poverty Bay	..	86	..	92	..	..	76	..	..	88	91	..	82	94
Cocksfoot—														
Danish	71	83	73	79	..	81	72	73	71	74	74	68	73	66
Akaroa	49	71	62	67	65	..	66	57	66	66	..	67	64	63
Plains	68	..	..	..	76	74	..	..	..	..	..	72	73	68
Dogstail—														
Southern	84	..	75	85	80	82	73	85	84	79	77	77	79	88
Sandon	86	..	68	86	88	75	91	80	75	81	..	77	80	90

* The three-figure averages shown up to May on mangold-samples were computed from tests in which the total number of sprouts per one hundred clusters were counted. From June the method was changed, and the number of clusters showing sprouts were taken as the germination percentage.

Table 5.—Average Percentage Purity and Germination of Perennial Rye-grass, Crested Dogstail, and Cocksfoot according to Origin, 1925 and 1924.

Origin.	Average Percentage of Impurities.	Percentage of Samples germinating				Average Germination.		Number of Samples.	
		81–90.		91–100.					
		1925.	1924.	1925.	1924.	1925.	1924.	1925.	1924.
Perennial Rye-grass.									
Southern ..	0·6	36	33	52	35	88	84	421	377
Canterbury ..	1·1	34	15	47	66	87	91	258	226
Sandon ..	0·5	21	36	10	28	67	82	122	157
Hawke's Bay	0·5	23	8	69	84	91	94	120	61
Poverty Bay..	..	30	5	50	80	81	94	13	23
Crested Dogstail.									
Southern ..	0·5	40	34	20	50	80	88	713	486
Sandon ..	2·0	22	24	40	65	80	90	67	75
Cocksfoot.		61–80.		81–100.					
Plains ..	3·5	36	60	45	12	73	68	11	24
Akaroa ..	4·0	59	50	7	10	64	63	70	100
Danish ..	0·9	42	41	40	25	73	66	127	152

Purity.—Table 6 shows the average purity (the percentages being broken up into useful and weed impurities), together with the percentage of samples in which the various impurities occurred. In two cases only—cocksfoot and Yorkshire fog (used mainly for export)—does the percentage of seed-impurity exceed 2 per cent., and in both these the bulk of the impurity is useful seed. Of the noxious impurities Californian thistle occurred to the greatest extent. It was noted in 60 per cent. of the Southern samples and 53 per cent. of the whole of the samples, at the average rate of 240 seeds per pound—the highest rate being 3,800 and the lowest two seeds per pound. Californian thistle was noted also in a very few samples of Chewings fescue, Italian rye-grass, and alsike. Ox-eye daisy was less frequent in occurrence, and was noted mainly in brown-top, cocksfoot, timothy, and Yorkshire fog. One sample of brown-top contained 5,000 seeds per pound, the average being 1,800. Dodder was noted in a single sample of brown-top, at the rate of 1,000 seeds per pound. This is an unusual impurity in grass-seed.

Brown-top samples contained on the average 31 per cent. of chaff and inert matter, the highest quantity being 65 per cent. Only a small number of fully dressed samples were received for testing.

Table 6.—Occurrence of the Main Impurities of the Grasses, 1925.

The figures placed after each impurity are the percentages of samples in which the impurity occurred in the species of seed at head of the columns—*e.g.* goose-grass occurred in 75 per cent. of the samples of perennial rye-grass examined.

Impurities.	Perennial Rye-grass.	Italian Rye-grass.	Western Wolths Rye-grass.	Timothy.	Crested Dogstail.	Cocksfoot.	Brown-top.	Chewings Fescue.	Yorkshire Fog.	Poa pratensis.
Total percentages ..	**1·2**	**0·7**	**0·4**	**1·7**	**1·3**	**4·0**	**1·8**	**1·7**	**9·1**	**1 0**
Useful Seeds.										
Average percentages	**0·7**	**0·5**	**0·2**	**1·5**	**1·1**	**3·6**	**0·7**	**1·1**	**7·5**	**0·2**
Perennial rye-grass ..	..	..	..	5	86	93	..	93	84	5
Yorkshire fog ..	40	7	..	9	95	71	18	77	..	7
Cocksfoot	29	..	7	..	40	..	4	44	38	6
Italian rye-grass ..	74	..	..	..	..	1	..	..	..	..
Crested dogstail ..	15	..	..	10	..	10	17	40	95	..
White clover ..	28	10	..	82	20	10	25	7	100	53
Suckling-clover ..	36	55	48	5	40	5	32	10	100	12
Alsike	19	..	4	68	5	10	..	3	58	12
Cow-grass	5	8	7	50	2	15	..	4	9	18
Poa pratensis ..	1	7	..	45	28	64	4	3	76	..
Agrostis spp. ..	2	..	..	22	8	11	..	2	5	59
Lotus spp. ..	..	3	..	..	..	..	77	..	..	..
Timothy	1	..	..	..	3	15	4	1	63	89
Weed-seeds.										
Average percentages	**0·5**	**0·2**	**0·2**	**0·2**	**0·2**	**0·6**	**1·1**	**0·5**	**1·6**	**0·8**
Hair-grass ..	68	58	57	8	36	12	23	60	10	..
Goose-grass ..	75	77	71	..	..	51	..	11	..	..
Catsear	35	13	14	..	68	25	52	90	9	6
Sweet vernal ..	10	10	4	5	29	7	27	47	90	..
Rib-grass	9	7	28	46	13	37	23	4	84	29
Sorrel	31	29	28	27	24	21	25	30	84	30
Curled dock ..	4	3	..	41	2	15	..	1	..	45
Californian thistle ..	2	3	..	6	53	..	..	1	10	..
Hawkweed ..	3	..	..	9	56	15	13	1	76	..
Ergot sclerotia ..	22	13	11	64	35	15	76	9	79	65
Ox-eye daisy ..	..	..	..	9	1	5	13	..	9	..
Fat-hen	2	..	4	14	..	4	..	..	14	12
Chickweed ..	1	..	..	15	10	4	25	2	71	24
Toad-rush ..	1	..	..	5	2	..	58	3	14	6
Hawk-bit	15	4	7	..	19	5	10	3	..	..

Table 7.—Average Germination and Purity of the Main Clovers, &c., 1925.

Species.	Percentage of Germination.			Percentage of Samples germinating between						Average Percentage of Impurities.			Percentage of Hard Seeds.
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.	Total.	Useful.	Weeds.	
White clover ..	89	100	36	11	1	2	4	22	60	3·3	2·6	0·7	11·3
Alsike ..	88	100	27	6	2	2	8	17	65	1·6	1·3	0·3	4·5
Cow-grass ..	88	99	10	4	2	3	7	18	66	2·6	0·3	2·3	4·8
Lucerne ..	88	100	62	..	2	3	13	35	47	1·6	0·5	1·1	8·1
English trefoil ..	79	98	32	9	5	8	16	25	37	0·3	0·1	0·2	4·6
Crimson clover ..	95	100	9	3	..	..	..	..	97	0·1	..	..	..
Lotus major ..	75	98	22	14	7	7	27	27	18	15·5	14·9	0·6	27·2
Subterranean clover	77	98	36	10	6	17	17	22	28	0·1	..	..	26·0

CLOVERS AND RELATED SPECIES.

Germination. — The average purity and germination of the main clovers, &c., are shown in Table 7. The average germination remains at much the same level as in preceding years. The percentage of hard seed still remains high, particularly in Lotus major, subterranean clover, and white clover, and is the cause of the depression of all the average germination percentages, except in crimson clover.

The average germination of clovers, &c., not included in the table is as follows :—

	Germination. Per Cent.	Hard Seeds. Per Cent.
Suckling-clover	.. 77·0	27·0
Egyptian clover	.. 95·0	..
Strawberry-clover	.. 75·0	25·0
Lotus hispidus (angustissimus)	.. 57·0	28·2
Lotus corniculatus	.. 54·3	42·0

Purity.—Table 7 shows the average percentage of impurity, divided into total, useful seeds, and weed-seeds. As is usual, Lotus major and white clover show the highest impurity, the greater part in both being made up of useful seed. On the other hand, cow-grass, usually looked upon as one of the purest of seeds, has a higher weed content than any of the other grasses and clovers. Reference to Table 8 shows this to consist of rib-grass, sorrel, and curled dock. Smaller percentages of suckling-clover in white clover were noticed, the highest being 9 per cent. Lotus hispidus was present in 45 per cent. of the Lotus major samples, compared with 90 per cent. in the previous year. The amount varied from 1 per cent. to 40 per cent., the average being 15·5 per cent. Some of the samples contained up to 12 per cent. of white clover.

As regards noxious impurities, only 8 per cent. of the white clover samples and 2 per cent. of the cow-grass samples examined contained dodder. This occurred in varying amounts, from fourteen to 1,500 seeds per pound. Twenty-one per cent. of the Lotus major samples contained dodder, from forty to 11,000 seeds per pound. Many of these were Auckland-grown samples. Californian thistle was noted in 11 per cent. of the alsike, in very small quantities.

The following extract from one of the tables of the annual report of the Official Seed-testing Station for England and Wales for 1924–25 is of interest in that it shows New Zealand red clover (cow-grass) and white clover in comparison with that from other countries from a purity and germination point of view :—

	Average per Cent. of Impurities.	Average Germination per Cent.	Average per Cent. Hard Seeds.
Red Clover.			
English	.. 4·29	73·9	4·1
French	.. 4·45	77·0	3·0
Czecho-Slovak ..	.. 6·70	84·5	6·5
Chilean	.. 2·01	86·5	4·4
American	.. 2·30	90·2	4·0
New Zealand	.. 1·32	90·5	4·3
White Clover.			
English	.. 6·32	83·7	6·7
Mid-European ..	.. 3·77	85·3	7·8
New Zealand ..	.. 2·82	80·1	15·7

It will be observed that in both species of New Zealand clovers the percentage of impurities is the lowest, and that the percentage of living seed (taking into account the hard seed) is also the highest.

Table 8.—Occurrence of the Main Impurities of the Clovers, &c., 1925.

The figures placed after each impurity are the percentages of samples in which the impurity occurred in the species at head of the columns.

Impurities.	White Clover.	Alsike.	Cow-grass.	Lucerne.	Lotus major.	English Trefoil.
Useful Seeds.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.	Per Cent.
White clover	..	100	65	7	70	12
Cow-grass	62	72	..	81	18	31
Alsike	87	..	35	..	20	20
English trefoil	21	95	18	6	..	..
Rye-grass	15	6	21	13	3	..
Lucerne	1	..	26	..	3	10
Timothy	38	94	5	..	45	..
Lotus spp.	4	..	..	..	45	..
Yorkshire fog	24	10	..	..	46	..
Crested dogstail	9	11	5	..	21	10
Suckling-clover	89	10	11	13	67	24
Poa pratensis	6	10	5	..	12	9
Cocksfoot	4	..	5	..	2	..
Haresfoot trefoil	16	..	3	..	6	..
Agrostis spp.	6	..	..	..	40	..
Weed-seeds.						
Sorrel	92	39	57	..	67	..
Rib-grass	66	28	90	19	49	40
Scarlet pimpernel	50	..	..	..	..	..
Chickweed	31	..	..	..	15	12
Catch-fly	31	..	..	..	12	..
Dodder	8	..	2	..	21	..
Spurrey	17	..	..	..	12	..
Mouse-eared chickweed	23	17	..	..	42	10
Selfheal	24	10	15	..	36	..
Fat-hen	52	6	9	13	6	10
Night-flowering catchfly	7	50	6	..	..	22
False flax	2	61	..	..	..	..
Californian thistle	..	11	..	..	..	..
Curled dock	1	10	54	19	..	32
Wireweed	7	..	21	18	..	9
Field-madder	5	6	20	6	3	80
Field-melilot	..	..	7	6	..	10

ROOTS AND CRUCIFEROUS FORAGES.

The average germinations of this class are given in the following table :—

Table 9.—Average Germination Percentages of the Main Roots and Cruciferous Forages, 1925.

Species.	Percentage of Germination.			Percentage of Samples germinating between					
	Average.	Highest.	Lowest.	0–50.	51–60.	61–70.	71–80.	81–90.	91–100.
Turnip	87	100	12	1	1	5	9	23	61
Swede	84	100	7	6	5	6	11	23	49
Rape	89	100	47	1	3	2	8	28	58
Kale	86	99	26	2	7	9	1	24	57
Mangold	74	95	22	6	8	20	32	30	4
Chou moellier	87	100	51	..	4	..	18	39	39
Carrot	69	92	25	11	11	34	30	10	4

CEREALS AND MISCELLANEOUS FORAGES.

The average germination percentages of these seeds were as follows: Wheat, 98; oats, 92; barley, 75; rye-corn, 95; Japanese millet, 94; Sudan grass, 88; sorghum, 71.

PEAS, TARES, AND LUPINS.

The average germinations in this class were as follows: Peas, 92; tares, 97; blue lupins, 83.

VEGETABLES.

The number of samples and the average germination percentages of the main vegetable seeds tested are shown in the following list:—

Seed.	Number of Samples.	Average Germination.	Seed.	Number of Samples.	Average Germination.
Beet ..	4	63	Melon	26	86
Broccoli	2	56	Onion	49	66
Cabbage	26	73	Parsnip	13	67
Celery	4	78	Parsley	3	41
Cauliflower	10	74	Pumpkin	6	84
Cucumber	14	86	Radish	5	91
Leek ..	6	65	Rhubarb	5	74
Lettuce	8	98	Spinach	10	17
Marrow	15	74	Tomato	10	92

GENERAL.

In addition to the more routine work of the Station some 870 miscellaneous laboratory tests were made during the year, also 117 special agricultural tests.

For purposes of further comparison, those interested are referred to the Seed Station report for 1924, published in the *Journal* for May, 1925.

Acknowledgment is made of the computation of the figures in this record by Mr. W. J. Cooch, of the Seed Station staff.

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 11th March to 22nd April, 1926, include the following of agricultural interest:—

No. 53149: Device for feeding cows in bails; I. B. Cruickshank, Otewa. No. 53404: Milking-machine; H. McCormack, Glen Ridge, New Jersey, U.S.A. No. 53674: Manure and seed distributor; W. M. D. Meares, Te Puna. No. 55710: Sheep-shear shear-plate; Chicago Flexible Shaft Co., Chicago, U.S.A. No. 53786: Tractor-wheel attachment; E. D. C. Withell, Mayfield. No. 53956: Milking-machine stripper attachment; J. H. Mason, Feilding. No. 54025: Cheese-press hoop; W. Harvey, Auckland. No. 54108: Separator; R. A. Lister and Co. and P. H. Watts, Dursley, England. No. 55800: Device for forming butter into blocks; J. A. Miller, Auckland. No. 54193: Milking-machine pulsator-valve; D. M. Wallace, Ltd., Hamilton. No. 55539: Milk sampling and weighing apparatus; J. J. Raynes, Rukuhia. No. 55767: Incubator egg-tray; M. C. Byrne, Bankstown, N.S.W. No. 54163: Tractor-seat back-rest; E. C. D. Withell, Mayfield. No. 55000: Sprayer-nozzle; J. C. Kay, Auckland. No. 55104: Animal-trap; W. and G. Sidebotham, Wednesfield, England.

Copy of full specifications and drawings in respect of any of the above may be obtained from the Registrar of Patents, Wellington. Price 1s.

SEASONAL NOTES.

THE FARM.

WINTER FEEDING OF STOCK.

On most dairy farms supplying factories the herd will now be dried off and feeding-out of supplementary forages should be general. Dairy cows should be building up for next season's lactation period. It is therefore necessary that they be given the best of treatment now, even if they have to go a little short in the spring. Cows that are well cared for during the winter will stand a pinch in the spring, when the days are getting longer and warmer. On the other hand, if they are neglected in winter and allowed to get low in condition no amount of spring feeding will make up for it. A cow down in condition is unable to get the best out of the food she eats; but if she is in good fettle she will make the most of the food value, and in consequence do better on a much smaller ration than that consumed by an animal in poor condition.

On farms where root crops are grown for dairy cows the roots should, as far as possible, be pulled and fed out to the animals. The average cow running on, say, a field of swedes will eat and spoil from 80 lb. to 120 lb. of roots per day. She would be healthier and do better on half this amount fed out on a clean paddock, together with some clean hay, at the rate of 15 lb. or 20 lb. per day. The hay should be carted out and spread thinly on dry areas to prevent loss by trampling. For sheep, when fed extra in this way, about 1 lb. of hay per day, together with 15 lb. to 20 lb. of roots, suffices. Hay is best fed to sheep out of racks.

Oat-straw, although of lower food value than hay, makes excellent feed for store stock. It is usually carted out to the paddocks and spread around. Wheat-straw is unpalatable and poor in food value, and as a rule should not be used.

Autumn-sown cereals and temporary pastures should be reaching usefulness during the coming month. Chou moellier and other kales are now providing forage, and should be fed with a reasonable ration of hay or other dry fodder.

In many districts dairy-farmers will now be using ensilage, and where cows are not used to this fodder a start should be made with a small quantity — say, 4 lb. to 6 lb. per head per day. This may be increased to 30 lb. or 40 lb. per day at the end of a week. The latter amount is the maximum quantity that it is desirable to feed at this season of the year. When starting to feed ensilage care should be taken to see that all is cleared up from day to day. When opening a stack or pit only a given surface area should be uncovered, the aim being to remove at least 6 in. from the top each day. Ensilage deteriorates rapidly, and should not be exposed longer than necessary; consequently it is better fed straight from the stack to the stock.

More use could with advantage be made of concentrates, especially for dairy cows. In general, the most suitable are crushed oats, crushed

linseed-cake, or peas. When used, a mixture is often fed in shallow troughs, together with chaff, at the rate of 4 lb. to 6 lb. of the mixture per head of cattle per day, or 1 lb. for sheep.

The most economical method of feeding off a crop of turnips or swedes with sheep is by folding. A block is fenced off and stocked with hoggets and old ewes, which eat off the tops. They are then put on to a new block, while the sheep intended for fattening are allowed to eat down the bulbs of the first block. The shells that remain are then grubbed out for the flock ewes. Sheep should not be put on to roots for too long a period at first, nor if there is frost on the leaves. If there is not a run-off on to a grass-paddock, racks with hay or straw should be placed in the field.

PASTURES.

Young permanent pastures should be very carefully managed during their first winter. They should not be grazed close, and never with heavy stock while the soil is inclined to be in a wet or sodden condition. Even sheep should be kept off if the ground is very soft.

The feeding of hay and roots on the poorer and drier spots of the older pastures, with the object of developing a better fertility and consolidation, should be continued.

During June and July opportunity should be taken to tripod-harrow old pastures while they are bare. Thorough harrowing of old pasture is important in removing harsh unpalatable growth, while at the same time assisting to invigorate the old crowns by breaking the surface soil and admitting the air so necessary to healthy plant-growth.

Stumping can now be conveniently carried out on the older bush-burns. The removal of logs, &c., will allow renovation methods to be put into practice. The tripod harrow will then be able to do its work, and, in conjunction with top-dressing, greatly improved pastures will result. Bracken and other fern and piripiri are torn out by the reversible tripod harrows, and can be thus more readily kept in check. Late autumn-sown secondary burns should now be top-dressed. This will result in a good spring growth, and allow heavy stocking to take place just when the bracken and other secondary growth is making a strong bid for mastery. Paddocks containing steep dangerous faces and "tomos" should now be spelled where practicable, heavy cattle at least being removed to easier ground.

Pasture top-dressing and liming were dealt with at some length in the *Journal* for March and April.

CULTURAL WORK.

Owing to the very dry autumn experienced in many districts this year cultural work has to a great extent been held in abeyance, but if proper provision is to be made for next season's root crops no time should be lost in getting selected areas turned over. Old pasture should be ploughed in wide furrows and laid flat where brown-top, Chewings fescue, &c., are troublesome. This method induces a better decay of the whole turf, and lessens the chance of these mat-forming species springing again between the furrows. Land recently cropped and now being ploughed for bare fallow should be left as rough as possible so that the greatest possible surface will be exposed to the weather.

Lea land can be ploughed fairly wet, but work should be discontinued if the furrow shows a glaze from the mouldboard. Recently cropped land should never be worked while wet, otherwise the soil-texture, which is very important, may be badly damaged, and this cannot easily be remedied. As far as possible at this season one should plough with the fall of the land, so that drainage may be assisted.

Where mangolds or potatoes are to be sown next spring, farmyard manure or old stack-bottoms should be carted out, well spread, and ploughed in. Early winter ploughing and plenty of organic manure are essential for these crops, especially potatoes.

If, during wet weather, low-lying patches of ground in the cereal crops become covered with water, these may be drained most easily by means of the mould-plough. With this implement a shallow drain can be made from the wet area to any convenient ditch.

LUCERNE.

Old stands of lucerne, if not yet attended to, and providing the soil is dry enough, should now be thoroughly grubbed and cleaned up, and where necessary limed. An average dressing would be 1 ton of crushed limestone per acre, or about 12 cwt. of crushed burnt lime. Keeping the stand clean through the winter is of great importance, having a very beneficial effect on the ensuing spring growth. Young stands sown in the past season should on no account be grazed this winter, and should receive a phosphatic top-dressing before spring. Where stands are weak in places and indicate nitrogen-hunger a dressing of suitable nitrogenous manure just as growth commences will greatly stimulate growth.

WORK IN THE IRRIGATION DISTRICT OF OTAGO.

In Central Otago where irrigation farming is practised the chief work, apart from ploughing, will be that of running contour ditches to those parts of the paddocks which could not be properly irrigated during the past season.

As the subsoils of Central Otago in general do not differ very materially from the surface and subsurface, deep ploughing should be resorted to. The reason why the surface soil does not differ much from the subsoil may be explained by the fact that the fine particles are not moved downward to any extent by percolating water. The subsoil of arid areas, as a rule, does not possess the raw or unproductive nature that characterizes the subsoil in most wetter districts. In Central Otago, therefore, with very few exceptions, deep ploughing may be done without detriment immediately preceding the sowing of the crop; in fact, the practice is of very great benefit, because it allows deeper root-penetration and a greater retention of moisture.

In certain parts of Otago only a light layer of mica-schist soil exists, the subsoil being more or less pure gravel. It would, of course, be folly to plough this type of land deeply or to use it for cropping purposes. The best method of dealing with it is to skim-plough and get it sown down in some such permanent crop as lucerne or grass. The ploughing-in of green crops of clover, mustard, and the like will also be of assistance in giving body and depth to light soils, and every irrigator should endeavour to build up the poorer types of soil in this manner.

—*Fields Division.*

THE ORCHARD.

THE PRUNING SEASON.

PRUNING of stone-fruit trees can now be proceeded with, and it is well to get this work advanced when the opportunity offers. Pruning is one of the phases of fruitgrowing that requires care and judgment, and it should not be entered upon without carefully reviewing the conditions relating to the previous season's performance of each particular tree, and noting the promise for the next season's crop. For instance, one may have to deal with peach-trees of an age when good judgment will decide that the previous crop has been too much for the tree, and the time has come to remove some of the older wood so as to encourage again that normal balance between wood-growth and bearing-capacity so much desired. The removal of small branches is generally preferable to removing large limbs, and the younger trees should be so trained that a permanent foundation be laid from which in later years there should be no difficulty in securing cropping-wood.

Plum-trees.

The Japanese varieties on the whole are sturdy growers, and can be shaped into strong, well-spaced trees, thereafter being kept pruned fairly hard each year, and retaining sufficient spear-like lateral growths around the main and sub leaders for cropping. Being mainly all vigorous growers, there is usually no dearth of good fruiting-wood to choose from, and it must be borne in mind that the Japanese varieties crop on yearling wood as well as on spurs.

After English plum-trees are trained to shape, lighter pruning is desirable, and a good proportion of medium wood-growths and laterals can be allowed to go uncut for a year or two till good crops are produced, when cutting-back can again be resorted to.

Cherry-trees.

According to the variety, trees of this fruit may be stiff and upright or willowy and pendulous. The former type should be framed as obliquely as possible, and the side shoots utilized to produce spurs and laterals for future cropping. The second type should receive careful attention and treatment to ensure stability and uprightness of growth during the first few years. When this is assured the pendulous growths can be encouraged for fruiting, and when these become too numerous some should be cut away from time to time in order to admit the light that is so essential to the ripening of the wood and spurs and to fruit-development.

Peaches and Nectarines.

The heaviest and most regular crops are obtained from trees kept in a comparatively vigorous condition. The young trees should be trained with a sturdy base, with mains tending toward the horizontal, so as to obviate overcrowding of the annual fruiting-wood in future years. Peach and nectarine trees vary a good deal in the way in which they carry the fruit, some varieties spurring more freely on the stouter wood than others, while others will not crop freely unless a proportion of the terminals of the lateral growths are left intact. The moderately strong shoots can be shortened back according to the positions of the fruit-buds. Some varieties carry the fruit-buds nearer the extremity than

others, and careful observation will guide the pruner as to the procedure. It should be borne in mind that the best fruit is borne on the shoots and laterals of the previous season's growth, and that the supply of this class of growth must be encouraged in the positions desired and according to the requirements of the tree. The small fruiting-twigs must not be pruned, but those not required for the current season's crop should be eliminated just above the basal buds, from which should be produced shoots for the next season.

Apricots.

In localities suited to the growing of this fruit heavy annual prunings can be resorted to on all free-cropping varieties. Like the peach, the young trees should be trained with a sturdy base and main limbs well spaced. On the free-fruiting varieties short fruit-bearing shoots spring from all round the limbs, and there is usually no very great difficulty in deciding which to eliminate or retain for fruiting. Some of the stronger yearling shoots can be retained in part where space will allow, which will produce desirable fruiting-wood for the next season and increase the production of the tree from year to year. There are some varieties, notably the Roxburgh Red, that require the retention of lateral growths uncut before good crops can be secured, and once the trees are well balanced very little pruning for a year or so is instrumental in bringing this class of tree into bearing. With the apricot pruning is not always the greatest factor to success. The tree is very susceptible to the influence of soil and climatic conditions, and the successful growing of this fruit outside the Teviot and Central Otago districts (with a few isolated exceptions elsewhere) should not be lightly entered upon. No system of pruning appears to be of definite advantage unless other conditions are suitable for its successful culture.

—*J. H. Thorp, Orchard Instructor, Nelson.*

CITRUS-CULTURE.

Citrus-trees will require light protection in localities which are known to be subject to frosts. Once trees have attained a height of several feet little damage is done except by very severe frosts. There are, however, many localities in which adult trees thrive quite well, but young trees require protection for the first few years. This protection is best afforded by a sack or scrim covering fixed to stakes or a clump of rough scrub-cuttings arranged to arch over the tree. Such shelter should not be made dense, but left rather open, on the north and north-east side in particular, to allow early and midday full sunlight. Trees which are so planted as to be exposed to wind or keen draughts through an insufficient shelter-belt will also winter better if protected by a screen.

During the winter season much damage is done by excessive moisture, and it pays to attend well to the drainage and disposal of surplus surface water.

The season is now right for the plantation of shelter-trees. Citrus-trees of all kinds are very sensitive to cold draughts, and this point is important in selecting a shelter-hedge, though first consideration must be given to plants known to succeed in the district and on the class of soil being dealt with. Equal consideration must be given to selecting a hedge-plant, or combination of plants, which will give shelter right to the ground.

In most citrus-groves drone trees are to be found—trees which have failed to crop satisfactorily, or which for some unknown reason are more prone to verrucosis. These is also the tree (very common in the Auckland district) of excessive vegetative habit. The working of these trees with buds from an approved tree will remedy this condition in shorter time than by planting a substitute young tree. Such trees should be cut back to the main arms now, and they will make quite a number of young shoots by spring, and give the required class of wood in which to insert buds.

—*W. H. Rice, Orchard Instructor, Auckland.*

POULTRY-KEEPING.

PREPARATIONS FOR THE HATCHING AND BROODING SEASON.

ALTHOUGH it will be several weeks yet before breeding and hatching operations commence, nevertheless there are many details that should be attended to in the interim. In point of fact, everything should be done to ward off avoidable trouble when the busy season arrives. The incubators and brooders should be carefully examined and special care taken to see that they are in thorough working-order. It may be found that fresh burners for incubator-lamps are required, or new connecting-rods for the machines where the old ones have been bent, or set-screws which have become worn and liable to cause a serious accident at any time. Maybe a new thermometer to suit some special make of incubator is required.

Where these and other duplicate parts of incubators or brooders are required it is a mistake to leave the purchasing to the last minute. Now that there are so many different styles and makes of incubators and brooders on the market it is often found difficult, or indeed impossible, to replace any part of them unless from the oversea country in which they are manufactured. It is quite a common thing for me to receive during the breeding-period urgent inquiries asking where some part of a particular make of incubator or brooder may be had, and usually the only reply I can give is that it is not procurable in the Dominion. It is safe to say that many an incubator (and, to a less degree, brooder) has had to remain out of commission during the whole or part of the hatching season merely because some duplicate part was unprocurable when required.

There are many other things that should be attended to at this comparatively slack season of the year—such as the cleaning-up of the plant, the mending of gates, fences, &c., and the sweetening of any stale runs by digging them over and planting some quick-growing succulent green-stuff suitable for the early hatched chicks. Such work done now will enable the necessary time to be devoted later to the critical work of hatching and brooding the new flock.

In successful poultry-keeping there must be a time for everything, and May to June is the period for doing all the odd jobs for which time cannot be spared at later periods of the year. It is always a wise course to prepare well ahead for the hatching and rearing season, then the drudgery so usually associated with poultry-keeping will be largely eliminated.

THE ADULT STOCK.

The favourable weather conditions generally prevailing of late will no doubt largely account for the great bulk of the birds which in many flocks have continued to lay to a much later date than is usually the case. Flocks have recently come under my notice where a surprising number of birds were still holding on to their old feathers and giving exceptional egg-yields for this season of the year. One breeder who has had this experience is anxious to know if I consider it a wise course for him to continue forcing his birds for eggs. He further asks whether this would not have the effect of weakening the stamina of the birds, especially seeing that they will later have to undergo the moulting process, and at a time when extremely cold weather conditions may be expected. In the case of birds intended for next season's breeding-pens I would strongly advise that they be discouraged from laying and encouraged to moult by providing a plain ration, also subjecting them to a change of quarters and frequent changes of diet. A good plan to hasten the moult and retard egg-laying is to supply an all-grain ration for a few days, and then suddenly change it to an all-mash diet. With birds that are to be kept for egg-production only I would recommend that an endeavour should be made to secure every available egg in view of the high current prices ruling.

Referring again to the prospective breeding-birds, the whole object should be to have these in the best possible condition by the time the breeding season arrives, and this cannot be done unless they have had good time to recuperate after an exhausting laying season. Obviously, the bird that has been forced to the limit right into the late autumn, and has later to undergo the heavy strain entailed on the system by moulting and renewing its feathers, will not be in a fit condition during the breeding-period to produce eggs with the strongest germs. On no account should the prospective breeding-bird be allowed to get into an overfat condition just prior to or when called upon to produce eggs for the renewal of stock, otherwise trouble may be surely anticipated. The treatment the birds receive now will largely influence not only the hatching-quality of the eggs, but also the vigour of the chicks produced. The aim should be to maintain the hens in a more or less lean, hard, healthy condition. This does not imply any stinting of diet. The birds should be well fed and nourished, but in order to prevent the accumulation of surplus fat they should be encouraged to take ample healthy exercise. If the breeding-birds are to be maintained in their best vigour, and be capable of producing eggs with a desired strength of germ, they should have a free range (or, at any rate, a good-sized yard), affording some semblance to the condition their nature demands. In a general way the coddled bird is not the ideal specimen to breed from for the maintenance of a heavy-producing flock.

THE AGE FOR CULLING.

A correspondent asks, "At what age do fowls become unprofitable to keep?" This is an inquiry which cannot be answered with any great degree of satisfaction. As with many other things connected with poultry, this question can be decided only after consideration of the quality of the stock and of the local conditions surrounding them. For example, in almost every flock are to be found individual birds that it will pay to discard at, or even before, the termination of their first

laying season—in other words, when they are about eighteen months old. The proportion of birds that should be culled from the flock at this age largely depends on the quality of the parents which the stock is bred from, also the manner in which the latter have been fed and managed. The wise poultry-keeper who ensures that no bird is bred from unless possessing outstanding points indicative of strong constitutional vigour and productive power, and, further, takes special care that the young stock are well fed and managed right through the whole of the developing stage, will have in his flock very few birds which will not more than pay their way for at least two laying seasons. Indeed, in a well-bred and well-managed flock of highly productive fowls many hens will be found that will give a profitable egg-yield (over the cost of their keep) right up to the end of the third laying season.

Thus the question of the correct age at which to cull fowls can be decided only in accordance with the quality of the individual members of a flock. Of course, it will seldom or never pay to keep a bird beyond the third laying season, unless it is of a noted breeding-type and is required for the breeding-pen. The man of experience with a trained eye for form can, with a great degree of certainty, by the observation of particular points in a bird, ascertain at a glance whether it possesses high or low egg-producing capacity, and whether it will pay or not to retain it in the flock, and this quite irrespective of the age of the bird.

In previous issues of the *Journal* much advice has been published relative to culling unprofitable stock, and I would urge my correspondents to carefully study and act on this advice.

—*F. C. Brown, Chief Poultry Instructor.*

THE APIARY.

WEEDS AND HIVE-STANDS.

Perhaps at no other season is it so necessary to keep the hive-entrances absolutely free of obstruction as at present. Vegetation during the next few months is rarely dry, even in fine weather, and the apiarist should see that when the bright sunshine of early winter days tempts the bees to a flight they run no risk of being caught in long grass, weeds, &c., thereby becoming chilled and losing all power of ever re-entering the hives. By removing such growths from around the hives now the entrances will remain clear for the next few months; and if the ground is treated with a dressing of agricultural salt in sufficient quantity before the spring growth starts there should be no trouble of the sort throughout the ensuing season.

In no case should hives be placed directly on the ground, or the bottom-boards will soon rot and have to be replaced. The hives should stand sufficiently high above the ground to avoid dampness, and it is an excellent plan to stand them on four half-bricks placed one at each corner of the bottom-board.

Should the apiary be in a permanent situation, no better plan can be followed than to provide concrete hive-stands. These stands have been used in New Zealand for quite a number of years, and have saved the users a great deal of labour by preventing the growth of weeds and by affording protection against insect-life. They are expensive to lay

down in the first place, but, being permanent, will remain in position indefinitely. If concrete stands are adopted they should extend a few inches in front of the alighting-boards, so as to prevent vegetation from growing too close to the entrances of the hives.

In all cases the hives should have a light cant towards the entrances in order to permit of the water leaving the bottom-boards readily. The presence of moisture will lead to much loss to the beekeeper, besides causing the hives to become sour and foul-smelling.

SHELTER.

With the approach of winter and its frequent rough weather the apiarist should turn his attention to the all-important question of shelter. Even if this provision entails a certain amount of outlay it will in the end prove one of the greatest economies the beekeeper can achieve. Not only does he obviate the danger of having hives blown over and lids removed, with the resultant losses by cold and exposure, but he will find in the spring that the well-sheltered, warmly situated colonies have wintered with not only a minimum of losses, but also with a minimum consumption of stores. The colony which has to winter in a cold, exposed situation will require to consume far more honey to keep itself alive than the colony whose compact cluster is unaffected by cold and damp. In the latter case, also, the bees will have a far greater degree of vitality with which to face the strain of spring breeding. Bees require just as much attention and care at the approach of winter as at the beginning of summer, and the careful beekeeper will see that they are so treated that, so far as his hives are concerned, he can regard southerly gales, snowstorms, and severe frosts with equanimity.

PLANS FOR NEXT SEASON.

During the off season is the best time to make plans for the following season. The beekeeper should decide what increases he desires to make, and should prepare accordingly. Making up hives and frames is exasperating work if left till the bees are crying out for room, and it should be finished long before the actual time for increasing one's stock arrives. The beekeeper should also face the question of providing himself with stocks of foundation, and make arrangements for the treatment of his surplus wax by some neighbouring maker of foundation. He should also decide on which market he wishes to place his crop, and lay his plans accordingly. It is advisable, too, that he consider the theoretical side of his occupation, and study, while the bees are in a dormant condition, the best methods of improving his stocks. Neither weather conditions, locality, nor any other factor will influence the honey crop so much as strong colonies of bees, and the apiarist should endeavour, while he has the time, to ensure that these shall be in existence during the coming summer.

THE BEEKEEPERS' ANNUAL CONFERENCE.

A reminder may be given that the National Beekeepers' Association meets in conference in Hamilton on 8th to 11th June inclusive. Papers dealing with various phases of the industry are to be read. A display of beekeeping appliances and honey competitions will form a feature of the proceedings.

—*E. A. Earp, Senior Apiary Instructor.*

HORTICULTURE.

VEGETABLE-GROWING.

THE month of June takes us fairly into winter, and at this period vegetable crops planted out about the New Year are being harvested, while others planted in late autumn are maturing for a harvest in early spring. Although the most carefully made plans have sometimes to be amended at the last moment, the successful planter has to constantly study the future and weave plans if the most is to be made of the "present" as it passes. In order that the planting season may not find one unprepared, the warmer, better-drained land suitable for the earlier crops must be taken in hand if it is not already receiving attention. Wet, rough weather will constantly interfere with the work; grass sod turned in takes time to rot; working out twitch and yarrow is a long tedious job; and hardy cover crops take time to grow. These are some of the reasons for an early commencement of the preparation of the soil for the first planting made on the warmer land at the beginning of spring.

Planting leads one to the consideration of seed, about which there are three points worth careful consideration. They are the kind, the variety, and the strain of seed to be planted. For a few generations it was the fashion to try and grow every possible kind of fruit and vegetable, and have them available at all seasons. This extravagance led to many wonderful horticultural feats being accomplished, and perhaps man's power to rule the vegetable kingdom was never more ably demonstrated than during that period.

In these days of economy, however, one avoids the more difficult and expensive undertakings, and humours nature by growing chiefly such crops as are suited to the soil and climate, and planting them at periods that are also naturally adapted. The more kinds of vegetables and fruits planted the more work is there in growing and marketing them. For this reason there is a tendency to grow rather larger areas of fewer kinds and those most suitable to the local conditions.

The perusal of a seed-catalogue with its long list of varieties of different kinds of plants is very attractive, especially the list of new varieties so big with promises; but here again fancy has to be ruled by local conditions and market demand. The result of such rigorous ruling gives a very much greater average result, although a delicate choice variety is sometimes ruled out as uncommercial. While the testing in small quantities of new varieties from reliable sources is well worth while, yet for the main crop one is well advised to sow such varieties only as are proved suitable to the district. The different qualities and habits in different varieties of the same kind of plants are extraordinary, and the reasons are frequently unknown.

The third point—seed-strain—is important; one may have a crop of broccoli of a variety commonly grown with success in a locality, but it is uneven in type, with many "rogues" (useless plants), the reason probably being that the seed has not been saved with that care which is necessary in order to obtain the best results. High-grade seed is expensive; the lower price of other grades of the same variety sometimes appeals, but it is disappointing, especially when suitable land and every other attention have been given. Disappointment is often entirely

due to this cause alone. As a commercial grower cannot afford to take this risk, every care is taken to get the best strain in vegetable and tomato seeds.

Small quantities of early-potato seed may be set out in trays to sprout, but the larger quantities are rarely given that treatment. It is important, however, that they be kept from growing long useless shoots and thus thoroughly spoiled. Bags of seed potatoes are best stored in the light under cool, airy conditions.

HOTBEDS FOR INDOOR TOMATOES.

Main-crop tomatoes to be grown under glass are usually started towards the end of June. As the seed is raised on hotbeds a commencement should be made to get the materials together. An even, lasting temperature is only obtained by setting up an even fermentation throughout the whole mass. This is done by placing the fresh stable manure in a compact heap, and, when fermentation has started, by restacking the heap, damping down dry material with water. This has the effect of distributing the fermentation, and after repeating it two or three times the correct condition is established throughout and maximum results are obtained.

Where a good, clean compost has been prepared over an extended period there need be little fear of trouble with the seedlings; but those who are not so fortunate as to have such a favourable start may prefer to sterilize the soil for the seed-boxes. This may be done by baking the soil, or by saturating it with boiling water or a 1-per-cent. solution of formalin. In the latter case two or three weeks should elapse before sowing.

SMALL-FRUITS.

Where the planting of bush fruits and strawberries has to be carried out every opportunity should be taken, when the land is dry, to thoroughly clean it of weeds and turn in suitable manures. Complete the planting of strawberries as early as possible, and the bush fruits any time the land is in condition after the preparation is complete.

TOBACCO-CURING.

The tobacco crop is now in the process of curing, and, although short in quantity owing to dry weather, much of it is in excellent condition so far. The temptation to cure unripe leaf should be resisted, for, like unripe fruit, its attractive qualities have not yet developed, and it can never be satisfactory to the consumer. Some growers are packing their leaf close together on the tier-poles, sometimes even tying stalks together and straddling them across the curing-sticks. This is at first an advantage in that the close, moist atmosphere develops a good colour in the leaf, but, if allowed to continue, the delay in drying out and a falling temperature induce moulds which are detrimental. As soon as a good colour is attained the quicker the leaf is dried the better it will be and the better it will keep. This can best be done by spacing it out sufficiently wide apart. A dusty tobacco is unpleasant to smoke, owing to the small particles drawn into the stem of the pipe. Good leaf is not only bright and even in colour, of heavy body, and good texture, but it should be whole. Torn leaves are seriously depreciated in value and cause dust and waste. —*W. C. Hyde, Horticulturist.*

REVIEW.

MONOGRAPH ON THE NEW ZEALAND BEECH FORESTS: PART I. THE ECOLOGY OF THE FORESTS AND TAXONOMY OF THE BEECHES. By L. COCKAYNE, F.R.S., Ph.D., F.N.Z.Inst., Honorary Botanist to the State Forest Service. Royal octavo; seventy-one pages, with forty-four illustrations and two maps. New Zealand State Forest Service Bulletin No. 4. Wellington: Government Printer, 1926. Price 4s.

THE Director of Forestry, the Forest Service officials, and their distinguished Honorary Botanist are alike to be congratulated on the publication of this valuable monograph. The present part deals with the purely scientific aspect of the problems, is written with the author's usual lucidity and vigour of style, and requires only a reasonable mastery of technical terms (for which a glossary is to be provided in Part II).

The objects of the research, the meaning of ecology, and the need for a Dominion forest policy based on a study of our own forests, and not on that of the very dissimilar European ones, are pointed out in the introduction. "By finding out, indeed, how nature works it becomes possible to utilize that knowledge and to draw up rules by which the natural processes can be hastened or retarded, and the forest made to behave, within limits, as the forester may desire." Cogent reasons are given for the important step taken in subdividing our forests into the classes (*a*) "subtropical rain-forest," (*b*) "subantarctic rain-forest," and for placing our southern-beech forests in the latter class. The reviewer regrets that the author has not retained, and the Service adopted, the term "southern-beech," rather than the still misleading "beech," though the utterly erroneous "birch" has, we hope, finally received its quietus.

The "Classification of the Beeches" is made clear by full and easily worked keys for the identification of the species and their hybrids, illustrated by excellent drawings and by reproductions of the original plates in *Icones Plantarum* (1844). The distinctiveness of *Nothofagus truncata* and *N. fusca* is well shown, and the differences between the often misunderstood *N. Solandri* and *N. cliffortioides* are so stated that further mistakes should be impossible. The fascinating matter of hybrid beeches is correctly dealt with only in sufficient detail for the purposes of forestry, but adequate directions are given for the recognition of such. The utter confusion of the popular names used is strikingly revealed, but the important matter of "how to remedy a state of affairs so utterly absurd" is reserved for Part II.

The distribution of the species is taken up in the third section, where is indicated both what is known and where further research is required. Armed with the information given in the preceding section the forest rangers can enter upon this task with confidence.

The section on the "Ecology and Classification of the Beech Forests" summarizes the results of the author's studies for nearly forty years. Details are first given of the ecology of the individual species, so far as it is known, but certain gaps in our knowledge—*e.g.*, the phenomena and causes of seasonal variation in flowering and fruit-setting—are indicated. Dr. J. S. Yeates has provided some information concerning the fungi investing the rootlets of southern-beech, but obviously much remains to be done, and the whole matter of root structure and distribution in relation to the growing-place of the plants awaits further investigation. The fundamental importance of the light-factor is insisted on, and is graphically illustrated (Fig. 18) by a photograph of sections of saplings of *N. Menziesii* growing within and without the forest.

An important subsection traverses the various factors governing the beech forest, its establishment and distribution—rainfall, wind, soil, temperature, altitude, the historical element (an interesting but contentious subject, here briefly glanced at), light, soil, plant-competition, indigenous animals, and introduced grazing and browsing animals. A photograph (Fig. 20) showing tussock-grassland at Hanmer replacing mountain-beech forest after burning is almost a replica of what the reviewer has seen in mountain-beech forest near Tophouse (Nelson), but there the replacement has been by way of fell-field with great mats of *Celmisia sessiliflora* and *C. spectabilis*, with other subalpine plants. So completely has the forest disappeared, except in the gullies, that were it not for comparative studies one would

conclude one was on a nearly virgin subalpine fell-field. The significance of such observations in connection with reafforestation will not be overlooked. Certain points discussed—*e.g.*, the grazing and browsing animal factor—have a bearing on pastoral problems met with by those having runs in southern-beech country. So, too, from this point of view, one could wish for a fuller treatment of "wet" and "dry" forest, so important for those converting southern-beech forest into grassland, though that does not properly concern the purposes of this monograph.

The discussion of the "Composition, Structure, and Ecology of Beech Forest" has an especial appeal to the general student of forest-ecology, and will be read with great interest by botanists abroad as well as in New Zealand. The reviewer would stress its importance for practical forest management. It would be a grave mistake to pass it over as merely of technical botanical interest, a misconception our Forest Service is clearly not under. No forester should remain content till he can identify with reasonable surety the components of the forest other than the obviously economically important trees. Not till he has such a knowledge can he learn the lessons that the forest has to teach. Here it may be pointed out that those groups of plants, the mosses, liverworts, and lichens, are referred to only in a very general way. But there is not the slightest doubt that so far from being plants merely for the enthusiast to amuse himself with, they are of the most vital importance for a thorough study of the life-history and economics of the forest. In the present state of our knowledge no more could be expected than the author has here given, but now that the proper study of our mosses has been made possible by the labours of the eminent specialist H. N. Dixon, and that specialists in other groups are prepared to lend assistance, it is not out of place to urge on the officers of the Forest Service the necessity for active work on these neglected groups. Nor should it be concluded that sufficient is known on any of the topics discussed (an idea that the author of the monograph would be the first to repudiate). The reviewer's own few excursions, for instance, to the Ruahine Mountains, have impressed on him the fact that much remains to be done before the southern-beech forests occurring there can be said to be at all well known.

The subsection "Regeneration of Beech Forest" is, as the author states, "perhaps the most important portion of this monograph." All concerned should study it closely, and pastoralists will here find much that concerns their activities. Any one who has seen the results of attempting to grass much of the southern-beech country of the North-west Nelson Botanical District will do well to ponder the remarks (page 60) on the results of burning, grassing, and grazing in the Upper Maruia Valley. Much still remains to be learned, doubtless, in regard to regeneration, but it is certainly correct to state (page 58) . . . "two points stand out clearly: (1) *That all the species of* Nothofagus *require for their rapid development more light than is provided by the average forest canopy*, and (2) *that development in full light outside the forest is at least about three times as rapid as in even a well-lit forest interior.*"

The bulletin concludes with a concise summary, followed by two maps showing the author's revised botanical districts. These maps are important for all botanists, over and above their special value for the monograph.

Not the least of the merits of the work is the fact that it will serve as a model—not by any means to be slavishly followed—for other workers, both in and out of the Forest Service. It is to be hoped that Part II, dealing with the application of the results here given and the exploitation of the forests, will be issued in the immediate future. It will certainly be eagerly awaited.

In the introduction the author has stated: "In addition to furnishing material for silviculture I have endeavoured to make this monograph of value for forestry students, including in that term not only those going through a course at the University, but those departmental officers (*e.g.*, the rangers) whose duties are intimately connected with the indigenous forests, as also such of the public as are interested in forestry and the open-air study of plants." To the reviewer these objects appear to have been achieved to a remarkable degree, and the tribute paid by the author to the zeal and enthusiasm of the forest rangers augurs well for the future of the Forest Service.

H. H. ALLAN.

New Rabbit District.—The constituting of the Mangare Rabbit-proof Fencing District (Auckland), for the purposes of Part IV of the Rabbit Nuisance Act, is gazetted.

WEATHER RECORDS: APRIL, 1926.

Dominion Meteorological Office.

GENERAL SUMMARY.

THE weather of the first three weeks of April, particularly over the North Island, was in strong contrast to the conditions prevailing during the last week. Fair weather, under anticyclonic conditions, was experienced until the 22nd, when barometric pressure decreased for the advent of an extensive area of westerly low pressure, with a humid and unsettled atmosphere.

There were traces of three areas of low pressure passing to the south of New Zealand, while the barometer stood fairly steady at about 30·4 in. for an unusually long period in the North.

Rainfall was below the average for April in all parts of the Dominion, except in Westland.

Easterly breezes were prevalent during the time of the anticyclone, and conditions were generally calm, sunny, dry, and mild. The break in the weather, with strong westerly winds, during the latter part of the month was very welcome and beneficial in most parts, but insufficient rainfall is still recorded in the east-coast districts, especially of the North Island.

—*D. C. Bates, Director.*

RAINFALL FOR APRIL, 1926, AT REPRESENTATIVE STATIONS.

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
North Island.				
	Inches.		Inches.	Inches.
Kaitaia	2·14	8	1·54	3·55
Russell	1·78	6	1·04	3·39
Whangarei	1·70	8	1·11	4·95
Auckland	1·56	11	0·56	3·46
Hamilton	2·76	9	1·50	3·64
Kawhia	3·09	7	1·22	4·75
New Plymouth	2·93	12	0·77	4·54
Riversdale, Inglewood	4·90	13	1·24	8·39
Whangamomona	4·41	10	1·14	6·68
Tairua, Thames	2·86	8	1·80	5·88
Tauranga	1·39	10	0·58	5·08
Maraehako Station, Opotiki ..	1·42	11	0·56	5·22
Gisborne	1·00	5	0·58	4·20
Taupo	1·35	5	0·46	3·95
Napier	0·34	5	0·21	2·92
Maraekakaho Station, Hastings ..	0·09	4	0·05	3·14
Taihape	2·35	8	0·69	3·15
Masterton	1·52	6	1·08	3·04
Patea	1·20	8	0·53	3·95
Wanganui	0·87	5	0·31	3·59
Foxton	1·68	6	0·52	2·57
Wellington	1·46	7	0·84	3·84
South Island.				
Westport	6·90	21	1·23	6·50
Greymouth	9·37	17	1·90	8·83
Hokitika	10·06	20	1·61	9·38
Ross	15·92	19	2·18	12·55
Arthur's Pass	13·41	14	2·83	17·64
Okuru, Westland	16·56	19	2·22	13·67
Collingwood	5·25	14	1·46	8·07

RAINFALL FOR APRIL, 1926—*continued.*

Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average April Rainfall.
South Island—continued.				
	Inches.		Inches.	Inches.
Nelson	1·59	9	0·58	2·93
Spring Creek, Blenheim ..	0·55	4	0·30	1·91
Tophouse	4·06	9	1·10	4·03
Hanmer Springs	0·32	4	0·15	3·12
Highfield, Waiau	0·30	3	0·24	2·85
Gore Bay	0·73	5	0·27	2·02
Christchurch	0·79	10	0·24	1·97
Timaru	1·00	9	0·34	1·51
Lambrook Station, Fairlie ..	0·89	6	0·21	2·00
Benmore Station, Clearburn ..	1·20	9	0·44	2·52
Oamaru	1·14	8	0·31	1·78
Queenstown	2·59	11	0·68	2·92
Clyde	1·42	9	0·58	1·34
Dunedin	1·24	14	0·58	2·82
Wendon	1·91	9	0·76	3·36
Gore	1·65	15	0·26	3·29
Invercargill	3·74	20	0·54	4·36
Puysegur Point	9·69	20	..	7·98

WINTER FARM-SCHOOL ITINERARIES.

A GENERAL programme of the Agriculture Department's short courses of instruction for farmers in the various districts this winter was published in last month's *Journal*. Itineraries of the "travelling" schools to be held in June and July are now available as follows:—

Otago.—Owaka, June 7th and 8th; Tapanui, 9th and 10th; Alexandra, 11th and 12th; Oamaru, 14th and 15th.

Southland.—Invercargill, June 16th and 17th; Gore, 18th and 19th.

Marlborough and Nelson.—Blenheim, June 21st and 22nd; Havelock, 23rd; Richmond, 24th and 25th (tentative dates).

Northern Hawke's Bay and Poverty Bay.—Wairoa, June 28th and 29th; Gisborne, June 30th and July 1st.

Manawatu, Southern Hawke's Bay, and Wairarapa.—Levin, July 12th; Palmerston North, 13th; Feilding, 14th; Dannevirke, 15th; Masterton, 16th; Martinborough, 17th.

Westland.—Centres for this school—to be held between July 19th and 24th—will be announced later.

FORESTRY LEAGUE COMPETITION FOR JUVENILES.

THE New Zealand Forestry League is offering prizes for collections of the foliage, flowers, and fruit of native trees, for boys and girls (1) over twelve and under sixteen years, (2) under twelve years—three prizes in each class. Specimens are to be of not less than twelve different trees. All collections of merit will be exhibited at the annual meeting of the League. Collections must reach the Secretary, New Zealand Forestry League, Dominion Farmers' Institute, Wellington, on or before 12th June. All particulars of prizes, conditions, &c., may be obtained from the Secretary.

Autumn and early winter top-dressings of phosphate give tone to the grass, and so to the heavy-in-calf cow.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

STAGGERY AND PARALYTIC CONDITION IN PIGS.

N. McLEOD, Te Kopuru :—

My young pigs, about five weeks old, are developing what we call "staggers" pretty badly. They are going in the hind quarters, but otherwise appear quite healthy. I would be very pleased if you could advise me of a remedy for this complaint, as it is fairly general throughout Northern Wairoa.

The Live-stock Division :—

This "staggery" and paralytic condition in pigs is frequently met with, and is believed to arise through error in dieting, coupled very often with bad housing-conditions. Seeing that your affected pigs are quite young, they will still be on the mother, but may be getting a little feed from the trough. If you are feeding sour milk it is to be expected that the young pigs will get indigestion, followed by other troubles. Continual feeding on sour milk or skim-milk alone is a common cause of digestive derangement. A sow which is suckling her young should have the milk supplemented by boiled roots and pollard, or some equivalent meal or grain. Keeping pigs on concrete floors without a plentiful supply of warm, dry bedding, or in wet and draughty sties, is doubtless a very important contributing cause of this form of paralysis. All swill-tubs and food-receptacles should be regularly scalded out with boiling water. Medicinally, you might give the pigs a small tablespoonful of castor-oil; and a teaspoonful of baking-soda added daily to the sow's food would probably prove beneficial. But unless all bad conditions of feeding and housing are rectified the use of medicines will undoubtedly be of no avail.

CONTROL OF DODDER IN CLOVER AND LUCERNE.

F. BRADLEY, Cromwell :—

I have some clover and lucerne paddocks infested with dodder. Could you advise me as to the best method of getting rid of it without ploughing, fallowing, and cultivating? Is it any use applying arsenic to the infected places?

The Fields Division :—

The best method of control, apart from eradication by ploughing and cultivation, is to cut the infected areas, fairly close to the crown of the plants, to about a yard out from the actual seat of infection, before the dodder seeds. Rake the cut stuff into heaps and mix it with dry straw or litter and burn it. Repeat the treatment if necessary. The dodder can also be controlled to a lesser extent by close grazing. This applies more in the case of clover, as lucerne will not stand very close cropping. The best stock for this purpose are sheep. Arsenic dressings could be applied to infected areas, but this method would entail much extra fencing-off, &c., or the complete spelling of the paddock for some time. Besides, it is a somewhat dangerous practice, as stock are liable to be poisoned for some considerable time after treatment. We therefore would not recommend the latter method, but would give preference to either or both of the first-mentioned methods —for clover, close grazing by sheep; and for lucerne, cutting and burning the infected herbage.

CONTAGIOUS STOMATITIS IN LAMBS.

W. N., Okoia :—

Could you advise any cure for sore lips and mouth in lambs? The lips are deeply cracked, swollen, and bleeding. Some of the lambs also have a very sore nose, with skin all rubbed off and quite raw. Affected animals very soon fall away in condition, as it seems almost impossible for them to eat.

The Live-stock Division :—

The condition affecting your lambs is known as contagious stomatitis. This trouble is best treated as follows : Separate all affected animals from the healthy ones ; wash the affected parts with a weak antiseptic solution, removing all dirt, discharge, &c., and then apply boracic or sulphur ointment. The ointment should be applied daily until recovery takes place. A change of feed is essential.

HAZEL AND WALNUT TREES.

A. C. HARRISON, Tauranga :—

Would hazel-trees make a hedge—not necessarily a trimly kept one ; and would stock damage the plants by nipping off the shoots over a fence ? Would establishment be with young plants or from cuttings ? What treatment of soil should be given, and what length of time would it take for the trees to bear ? Also, what length of time do walnut-trees take to bear ? Should they grow fairly well here ? It is rather windy where we are situated. Could you recommend one or two good commercial varieties ?

The Horticulture Division :—

Young hazel-trees are best obtained from a reliable nursery and planted out in moist land that is of medium quality only. Planting on good land, as is usually done, results in strong vigorous growth with very few nuts. With proper treatment the trees should commence to bear in five or six years. So many kinds of trees and shrubs are sometimes injured by cattle browsing on them from over a fence that it is best not to take any risks, but plant them at a safe distance. While the hazel-nut is often planted as a hedge or screen, one rarely finds it cropping well under such circumstances. It requires to be pruned and trained in an open manner for that purpose, which usually renders it unsuitable as a hedge. Walnut-trees require a good, well-drained, alluvial soil, and suitably worked trees should commence to bear in eight or ten years. Franquette, or a well-selected variety of the English walnut, should suit your purpose.

ABORTION FOLLOWING BLOATING IN COW.

"SUBSCRIBER," Otane :—

I have had a number of cows badly bloated on lucerne this season, and had to knife several as a last resort. In the last case I used a trocar, allowing it to go in the full depth. About ten days later the cow aborted, about four or five hours after milking, there being no sign of anything unusual then. The calf would be five months. Do you consider this a case of abortion (contagious), or merely the after-effects of bloating through the animal being injured internally, so causing the calf to die ?

The Live-stock Division :—

We do not consider that the abortion was due to the contagious disease in this case. Abortion following acute bloating in pregnant animals is not uncommon —in fact, is a recognized sequel to the tympanitic condition.

FORTHCOMING WINTER SHOWS.

Franklin A. and P. Association : Pukekohe, 28th and 29th May.
Otago A. and P. Society : Dunedin, 1st to 4th June.
Waikato Winter Show Association : Hamilton, 1st to 5th June.
Auckland Winter Exhibition : Auckland, 9th to 19th June.
Manawatu A. and P. Association : Palmerston North, 15th to 19th June.
Wanganui A. and P. Association : Wanganui, 24th to 26th June.
South Taranaki Winter Show Company : Hawera, 30th June to 7th July.
Wellington Show Association : Wellington, 10th to 24th July.